OUTCOME ANALYSIS OF INTERNAL FIXATION OF FRACTURES WITH MUSCULO SKELETAL INFECTIVE FOCI ELSEWHERE IN THE BODY

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CERTIFICATE

This is to certify that this dissertation in **"Outcome Analysis Of Internal Fixation Of Fractures With Musculoskeletal Infective Foci Elsewhere In The Body"** is a bonafide work done by **Dr.S.Syed Naser** under my guidance during the period 2013–2015. This has been submitted in partial fulfilment of the award of M.S. Degree in Orthopedic Surgery (Branch–II) by The Tamilnadu Dr.M.G.R. Medical University, Chennai.

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DECLARATION

I, **Dr.S.SYED NASER,** solemnly declare that the dissertation titled **"Outcome Analysis of Internal Fixation of Fractures with Musculoskeletal Infective Foci Elsewhere in the Body"** was done by me at the Rajiv Gandhi Government General Hospital, Chennai-3, during 2013-2015 under the guidance of my unit chief **Prof.N.DEEN MUHAMMAD ISMAIL, M.S(Ortho)., D.Ortho.,**

The dissertation is submitted in partial fulfilment of requirement for the award of M.S. Degree (Branch –II) in Orthopaedic Surgery to The Tamil Nadu Dr.M.G.R.Medical University.

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ABBREVIATION

CRP	C-Reactive Protein
ESR	Erythrocyte Sedimentation Rate
TLC	Total Leucocyte Count
WBC	White Blood Cells
CONS	Coagulase Negative Staphylococcus Aureus
SSI	Surgical Site Infection
MSSA	Methicillin Sensitive Staphylococcus Aureus
MRSA	Methicillin Resistant Staphylococcus Aureus
VAS	Visual Analog Scale
POD	Post Operative Day
PII	Post Operative Implant Infection

OUTCOME ANALYSIS OF INTERNAL FIXATION OF FRACTURES WITH MUSCULO SKELETAL INFECTIVE FOCI ELSEWHERE IN THE BODY

AIM & OBJECTIVE :

To evaluate the outcome of internal fixation of closed fractures with musculoskeletal infective foci elsewhere in the body. This study will provide possible variations in the outcome of this study.

METHODS :

This is a retrospective cum prospective analytical study in 15 patients presented with closed fractures with musculoskeletal infective foci elsewhere admitted in Institute of Orthopaedics & Traumatology, Madras Medical College , Rajiv Gandhi Govt General Hospital, Chennai from July 2013 to Aug 2014. This study applies strict inclusion and exclusion criteria's with recommended guidelines of treatment. Pre and post operatively, both C R P & E S R values were obtained and interpretated. Wound swab culture and sensitivity was done at pre operatively and post operatively. Appropriate antibiotics were given at pre operatively and post operatively. Fracture fixation by open surgical methods is done to obtain anatomical restoration of articular surface & acceptable reduction of the fracture fragments.

RESULTS :

In our study, outcome analysis of internal fixation for fifteen (15) patients were analysed. Organisms found in infective focus are not seen at surgical site, which was confirmed by drain tip swab culture & sensitivity after 2nd POD. Post operatively all patients showed CRP value < 6 at 4th POD & end of the 4th Week(28th day), Though we are able to isolate the organisms from the distal musculoskeletal infective foci pre operatively, there was no superficial surgical site infection as well as post operative implant related infection from the distal musculoskeletal infective foci.

CONCLUSION :

A short term follow up of our study results have encouraged us in preferring the surgical management of fractures with musculoskeletal infective foci elsewhere in the body with proper pre op planning. From our study, irrespective of the wound status with the recommended normal value of c reactive protein, outcome of internal fixation of closed fractures were found to be safe and effective.

CONTENTS

INTRODUCTION

Management of infection in orthopaedic implants at the post operative period are particularly challenging[1]. The incidence of infection of orthopaedic implant is low, from approximately one percent in primary replacement surgeries to three percent in revision arthroplasty procedures. Overall, five percent of orthopaedic implant fixation was infected[1]. This lower rate of infection is due to awareness of best aseptic precautions[1]. High risk of infection is associated with increased use of implants in orthopaedics[1]. Patient with infection in the bone secondary to operative procedures will lead to chronic osteomyelitis and lifelong disability[1].

Another factor for infection is diminised circulation to bone. Intra medullary reaming of bone causes necrosis of the bone tissues in the adjacent area, further compromising endosteal circulation which causes damage to the bone tissue[1].

Dead space after implant insertion favours collection of blood in that space around the implant. It accentuates the possibility of infection since hematoma in the operated site promotes bacterial growth[1] .

Several unmodifiable factors make the patients prone to infection when they undergo fracture fixation[1,7]. In patients with diabetes, rheumatoid arthritis , lupus , haemophilia and chronically debilitated patients, staphylococcus aureus is the common organism to produce bone infection[1]. The presence of orthopedic implants in the operated site is enough to produce infection even with minimal bacterial concentration in that patients.[1,12]

The patient's skin flora is the prime reason for surgical site infection[14]. During the operative procedures, staphylococcus epidermidis can invade even through the surgical site incision[14]. Operated site presents with or without discharge. Infection may manifest as redness, warmth and discharge locally[12].

Dead and dying cells release chemical factors which causes the liver to produce C Reactive Protein. C Reactive Protein measurement is used to detect infection and inflammation of the distant musculoskeletal tissues elsewhere in the body pre operatively as well as to monitor early occurrence of post operative infection and provides prognosis of the treatment.

Internal fixation provides temporary support. For internal fixation, neither the strongest nor the stiffest implant is necessarily optimal. Before choosing an implant material, several ideas have to be considered[1].

Depending on the requirements, stainless steel or titanium are used for internal fixation[1]. The orthopedic implants are of different types which are used during surgery. The devices such as nails and plates are utilized for internal fixation of fractures[1].

Although fracture healing is only one element in functional recovery, its mechanics, biomechanics, and biology should be understood. For biological or biomechanical reasons, it is often necessary to sacrifice some strength and stiffness to achieve fracture healing.[1]

Under critical conditions, the mechanical requirements may be more demanding than the biological advantages[1]. Every surgeon must determine which combination of technology and procedure best fits his experience, environment, and in particular the demands of the patient.[1]

Antibiotics are very useful to decrease the surgical site complications after internal fixation of closed fractures & joint replacement surgery. The timing, type and dosage of antibiotics are very important[15,17,19,27,31,28].

Many surgeons prefer to administer antibiotics 30 minutes before the surgical incision[1]. Antibiotics administration after surgery is not necessary for all patients[1,2,3]. But it is mandatory for the patients if the infective foci is present elsewhere. It should be continued till both the surgical site & infective foci heal[3,12]. Broad spectrum antibiotics such as Beta lactum group are preferable in this situation[3].

Lambotte's principles of operative treatment are restoration of articular surface if fracture involving the joint , maintain proper length & alignment, stable fracture fixation, early joint mobilization to achieve good outcome[2].

Lane's hypothesis suggests no touch technique that prevent infection during operative procedures. Lane's forceps is used to hold the bone during operative procedures which prevents handling of the bone by surgeon's hand. This is to avoid the life threatening complications like infection and sepsis and implant failure[2].

Lister's antiseptic precautions for infective microbes has changed the scenario. Antibiotic use before and after surgery reduced the infection rate much more. But the development of antibiotic resistance has become the emerging problem now[1].

Identification of patients at highest risk for postoperative infections prior to surgery would aid clinicians in targeting perioperative preventive strategies and in selecting patients for close postoperative monitoring.

The complications of implant infection such as osteomyelitis , non union, delayed union, soft tissue infections can have profound impact on the physical and social well being of the patient. It is effective and easy to prevent the complication before it develops than to treat after the complication develops[1] .

Hence internal fixation of closed fractures with implant always prompt a chance of implant infection in the mind of a surgeon in a case of culture proved distant musculoskeletal infective foci elsewhere in the body. In this scenario, direct answer to the question regarding implant infection due to culture proved distant musculoskeletal infective foci has found to be illusive. Certain papers have investigated retrospectively for the infection occurring in implants after surgery from the distal infective foci[5,8,9,11,43]. Hence we analysed the outcome of internal fixation of closed fractures by implants with culture proved distant infective musculoskeletal foci elsewhere in the body.

AIM & OBJECTIVE

To evaluate the outcome of internal fixation of closed fractures with culture proved distant musculoskeletal infective foci elsewhere in the body.

This is a study of the patients , presented with closed fractures with culture proved distant musculoskeletal infective foci elsewhere, admitted in Institute of Orthopaedics & Traumatology, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai underwent internal fixation with implants.

Postoperatively, the patients were followed up for the outcome of internal fixation of fractures and analyse the complications such as superficial surgical site infection and deep implant related infections, delayed union, non union, chronic osteomyelitis, stiffness.

REVIEW OF LITERATURE

On reviewing the literature, direct answer to the question regarding implant infection due to distant musculo skeletal infective foci has found to be illusive.. Certain papers have investigated retrospectively for the infection occurring in implants after surgery from the distal infective foci.

In **1840, Curtis et al** suggested that a focal infection is a localized or generalized infection caused by the dissemination of organisms or toxic products from a focus of infection. It probably would be better defined as a metastatic infection[39].

In **1905, Lane's** introduced no touch technique and aseptic precautions for surgery and minimal soft tissue dissection during surgery to prevent post operative infection[2].

In **1907, Lambotte's** described the principles of the internal fixation to achieve good outcome[2].

In **1916 , Billings et al** gave the first definition of a focus of infection. He described focus of infection is a circumscribed area of tissue infected with pathogenic organisms. Foci may be primary or secondary. Primary foci usually are located in tissues communicating with a mucous or

cutaneous surface. Secondary foci are the direct result of infections from other foci through contiguous tissues, or at a distance through the blood stream or lymph channels. Primary foci of infection may be located anywhere in the body[37].

In **1941, Solis-Cohen et al** elaborated this concept by pointing out that "a focus is bacterial and not structural".[38]

In **1941, Shuster et al** states that focal infection implies metastasis from the infected foci, of bacteria or their toxins, capable of injuring contiguous or distant tissues[40].

In **1957, Elek et al** suggested injection of $10^{\times 6}$ Staphylococcus bacteria subcutaneously never produce infection if orthopaedic implant was not present. In other way, presence of orthopaedic implant , implant related infection occurs commonly & easily even at minimal bacterial concentrations as few as 100 organisms[1].

In **1976, Fisher et al and Shih et al** and in **1984, Aalto et al** have also reported that CRP show a rapid postoperative rise reaching maximum level on 2nd postoperative day followed by a sharp decline. They further observed that ESR values reached their peak value at variable period upto the end of 1st postoperative week followed by slow decline. This aspect of

the CRP profile can be used to diagnose postoperative and post-traumatic septic complication. Subsequent rise in the CRP levels or persistently high values beyond third day should alert the surgeon of possible septic complication. The same cannot be said with certainty about other parameters (TLC, ESR) because of their smaller rise, peak on variable days and subsequent smaller decline which might conceal a possible infectious complication. Moreover wide variation of TLC and ESR in normal population makes it difficult to interpret their absolute postoperative values[39].

In **1982, Waldvogel et al** suggested staphylococci variety is the common cause of post operative implant infection even upto three fourth of the patients[11,12].

In **1983, Charnley et al** recommended that antibiotic prophylaxis reduces the infection post operatively[5,27].

In **1987, Mustard et al** suggested that CRP has a high negative predictive value in ruling out postoperative infection. Higher negative predictive value of CRP indicates the sharp decline of CRP level beyond third day after trauma not followed by any subsequent rise does ensure the exclusion of any post-traumatic septic complication[35].

In **1989, Morrissy and Haynes et al** described even low energy trauma can produce infection by producing necrosis of bone[1].

In **1991, Ellitsgaard et al** done a study that showed elevation of CRP and ESR within the week post surgery of 140 patients with fracture around the hip[32].

In **1991, Meyer et al** recommended the importance of inflammatory parameters with their sensitivity,specificity,positive predictive value & negative predictive value. Bernard,Sanzen and Carlsson,Shih.,Spangehl described the importance and significance of the C Reactive Protein[8,9].

In **1996, Niskanen et al** have also reported that a pronounced rise in CRP level on the second and third postoperative day after a major orthopaedic operation is normal but a further rise at one or two weeks suggest the presence of a serious complication[40].

In **1996, Hebert et al** told importance of air flow in theatre and significance of antibiotics pre operatively[1,5,14].

In **1999, Mangram AJ et al** concluded that surgical site infection is the 2nd most common infection in health care associated infection particularly in surgical patients. He described surgical site infection into

three groups such as superficial incisional SSI, deep incisional SSI, organ/space SSI. He recommended guidelines for prevention of surgical site infection. He also described principles of antibiotic prophylaxis[11].

In **1999, Segawa et al** described that almost all postoperative implant infections are produced by aerobic,gram + ve group[1,25]. \

In **2004, Dale W bratzler et al** recommended antimicrobial prophylaxis for surgery[6].

In **2004, Zimmerli et al** suggested , in the post operative period one group of staphylococcus i.e CONS is predominant in implant infection, while S. aureus is less common[3].

In **2004, Bernard et al** found that there is less number of studies analysing implant infection diagnosis and treatment[1].

Bernard et al, Cuckler et a, Duff et al, Flivik et al, Lachiewicz et al, Roberts et al, Sanzen et al, Thoren and Wigren et al described the sensitivity,specificity of the Erythrocyte Sedimentation Rate at various periods[1,25].

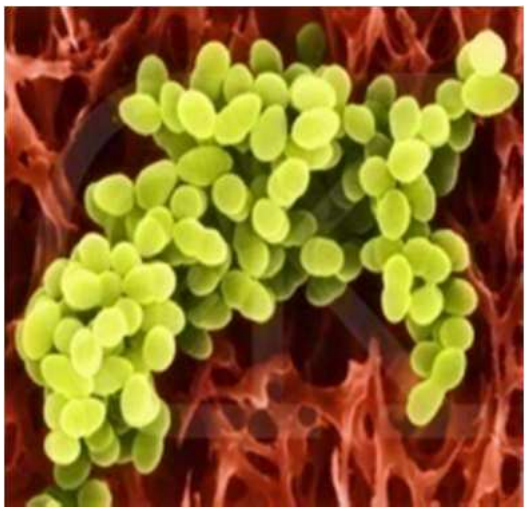
Spangehl et al, Duff et al, Flivik et al, Bernard et al, Lachiewicz et al suggested the sensitivity, specificity of the polymorpho nuclear cells count at various periods[1,25].

ETIOLOGY

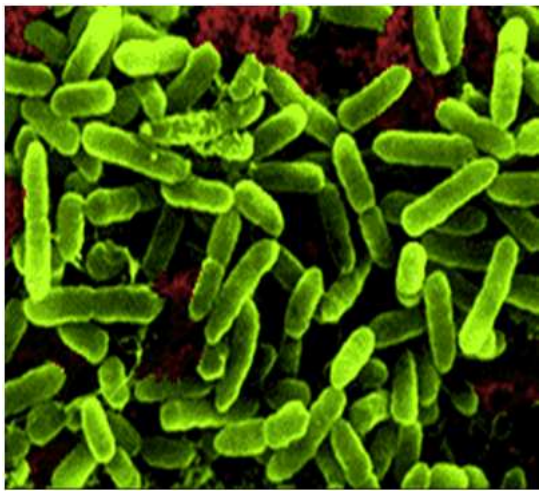
FREQUENCY - MICROORGANISMS

Gram positive aerobic cocci i.e staphylococcus aureus was found in almost 30-50 % of patients[1]. Gram negative group was found in less number of patients[1].

GRAM-POSITVE COCCI



GRAM-NEGATIVE RODS



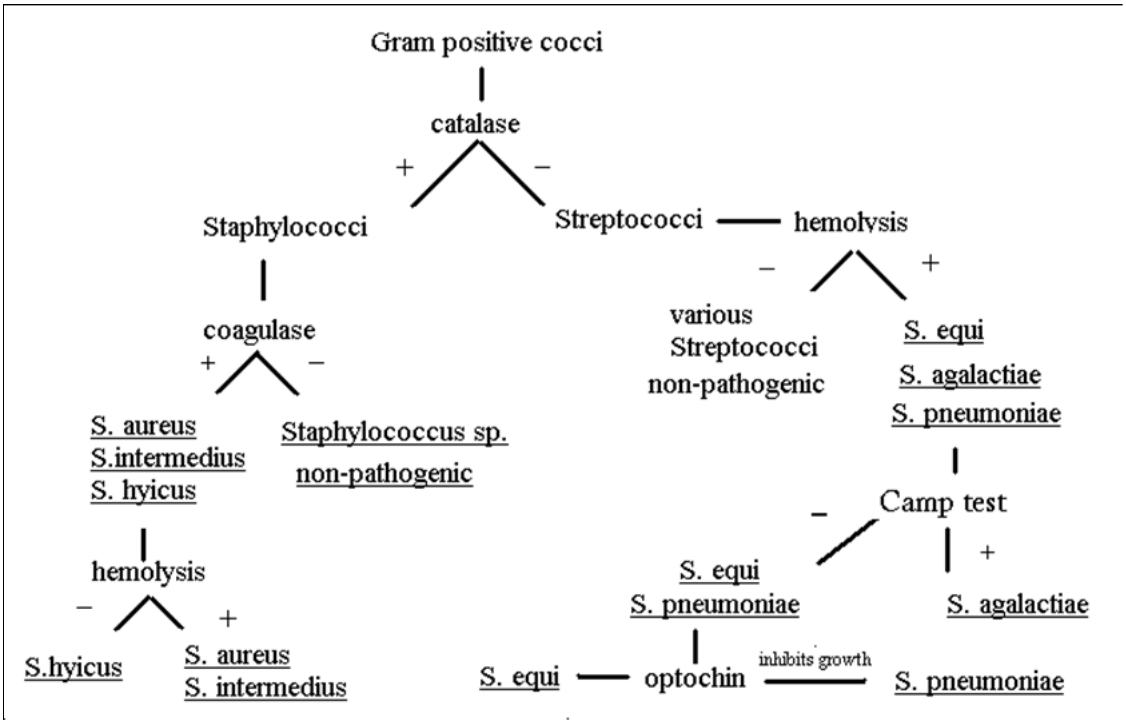
The table contents shows prevalence of bacteria in patients with infections associated with fracture in decreasing order of frequency . Staphylococcus aureus is the most common organisms accounting for about 30%.

Microorganism	Frequency(%)
Staphylococcus aureus	30
Methicillin-resistant *Stoplrylococcus aureus* (MRSA)	Was present in 2 of 40 cases (5%) infected by *Staphylococcus aureus*
Coagulase-negative staphylococci	22
Gram-negative bacilli	10
Anaerobes	5
Enterococci	3
Streptococci	I
Polymicobial	~27
Unknown	2

M R S A strains are now increasing[1,11]. The patient is having M R S A strains in the wound site needs alternative therapy such as vancomycin. Coagulase negative staphylococcus aureus strains also found in some patients[1,12].

SUBGROUPS – STAPHYLOCOCCUS GROUP

The flow chart shows gram positive cocci family and its subgroup. Gram +ve cocci are divided into staphylococci and streptococci by catalase reactions. Staphylococci is further divided into subgroups by coagulase reactions .



STAPHYLOCOCCUS -- SUBGROUPS

PATHOGENESIS

CLASSIC DIAGNOSIS OF INFECTION

The clinical signs are sepsis wound appearance , fever with chills and rigor associated with elevated White Blood Cell count with increased proportion of polymorphonuclear cells .There should be elevated Erythrocyte Sedimentation Rate and C Reactive Protein[14].

SIGNS / SYMPTOMS ARE OFTEN NOT PRESENT IN ORTHOPEDIC INFECTIONS

Systemic signs may be absent in orthopedic implant related infection. There may be normal white blood cell count. In early postoperative infection, X rays features are normal[1,11,12].

CLINICAL SUSPICION OF INFECTION

Persistent pain in the operated site with inflammatory appearance (redness, warmth) wound drainage at operated site are present in implant related infection. In X rays Periosteal new bone, demineralization or a sequestrum may be seen in chronic infections[12,14].

Difference between colonization and contamination are illustrated below:

COLONIZATION	CONTAMINATION
• Bacteria present in a wound • No signs or symptoms of systemic inflammation • Usually less than 10*^{5} cfu/ml	• Transient exposure of a wound to bacteria • Varying concentrations of the bacteria • Time of exposure < 6 hours

INFECTION - SURGICAL SITE

Mangram described the incidence of infection at operated site is 2 – 5 %. The second most common is hospital acquired infection i.e Health Care Associated Infection. Nearly 40 % of patients with surgicsl site infections are mainly nosocomial[11].

DEFINITIONS

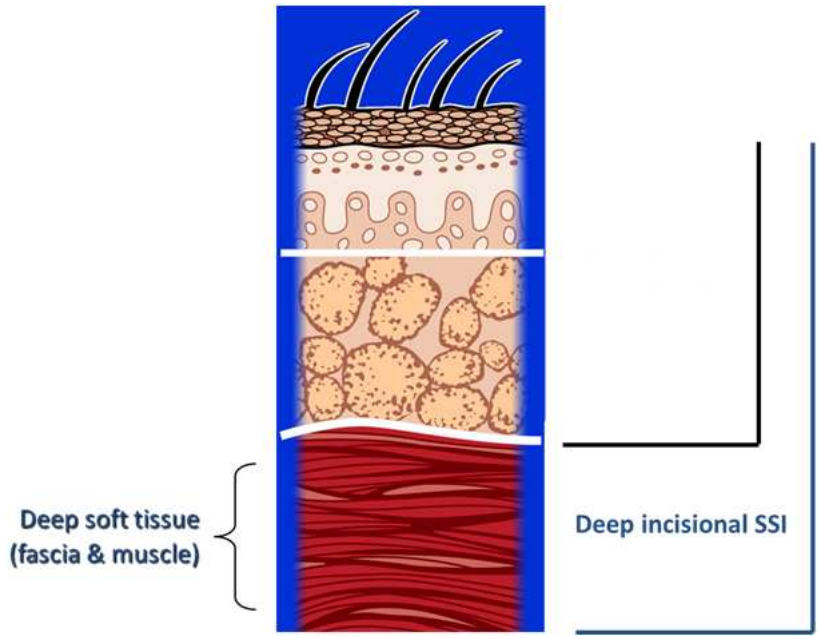
Surgical Site Infection	• Systemic and local signs of inflammation • Bacterial counts $\geq 10^5$ cfu / mL • Purulent versus nonpurulent

SUPERFICIAL INCISIONAL SSI

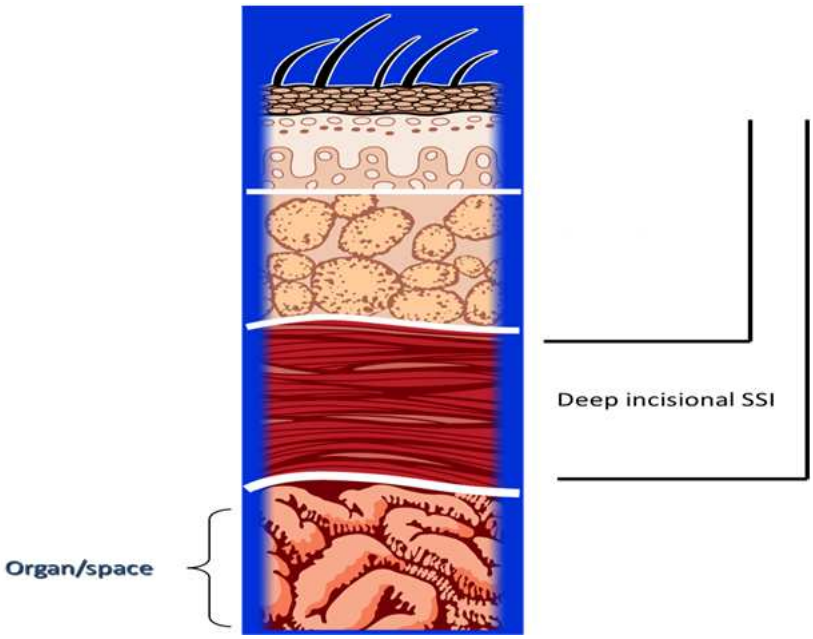
Superficial SSI is the most common (50% of all SSI). 2/3 of patients are affected with superficial level of infection. The remaining percentage of patients are affected, by deep seated infection involving organ or implant or foreign body .Post operatively , the patients have to be reviewed frequently to prevent complication like implant related infection[11].

SURGICAL SITE INFECTION (SUPERFICIAL)

SURGICAL SITE INFECTION (DEEP)



SURGICAL SITE INFECTION (ORGAN)



SUPERFICIAL INCISIONAL SURGICAL SITE INFECTION[11]	DEEP INCISIONAL SURGICAL SITE INFECTION[11]	ORGAN/ SPACE SURGICAL SITE INFECTION[11]
• Involves only skin and subcutaneous tissues • Does not involve the deep fascia and • Underlying muscles	• Infection involves the deep soft tissue (e.g., fascia and muscle layers)	• The infection involves any part of the anatomy other than the incision, which was opened or manipulated during the operation

SSI :Risk Factors[11] **Operation Factors**	**SSI :Risk Factors[11]** **Patient factors**
• Duration of surgical scrub • Skin antisepsis • Preoperative shaving • Duration of operation • Antimicrobial prophylaxis • Operating room ventilation • Inadequate sterilization of instruments • Foreign material at surgical site • Surgical drains • Surgical technique • Poor hemostasis • Failure to obliterate dead space • Tissue trauma	• Age • Diabetes • HbA_{1C} and SSI • Glucose > 200 mg/dL postoperative period (<48 hours) • Nicotine use: delays primary wound healing • Malnutrition: no epidemiological association • Obesity: 20% over ideal body weight • Prolonged preoperative stay: surrogate of the severity of illness and comorbid conditions • Coexistent infections at a remote body site • Altered immune response

CLASSIFICATION OF WOUND

The wound has been classified into four classes[11].

Class 1	Clean (Prophylactic antibiotics not recommended)
Class 11	Clean contaminated (prophylactic antibiotics recommended)
Class 111	Contaminated (therapeutic antibiotics recommended)
Class 1V	Dirty

Prophylactic antibiotics is not needed for the clean wounds which comes under Class I category.Prophylactic antibiotics are indicated for clean contaminated wounds.Therapeutic antibiotics are recommended for contaminated wounds.

CLEAN WOUND

CLEAN CONTAMINATED WOUND

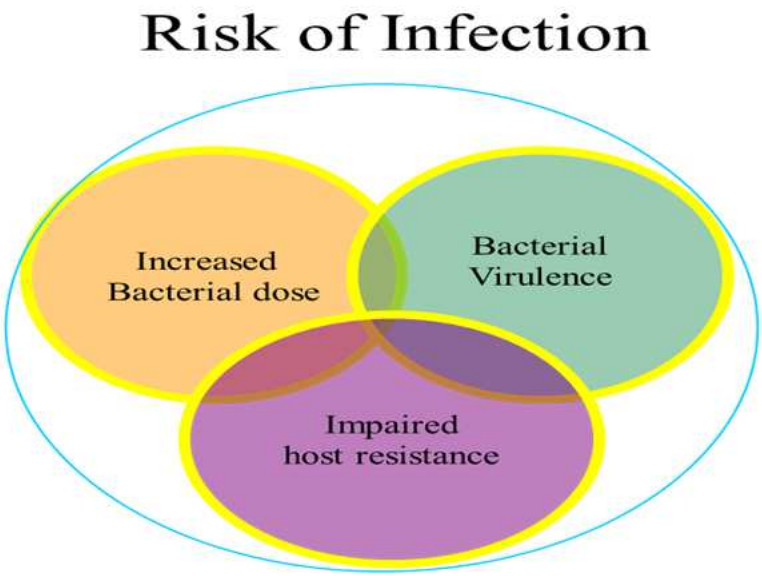
PATIENT, PRESENCE OF IMPLANT AND BACTERIAL INTER RELATIONSHIP[11,14]:

1) Increased bacterial dose

2) Impaired host resistence

3) Bacterial Virulence

These factors are mainly responsible for the infection which is illustrated below.

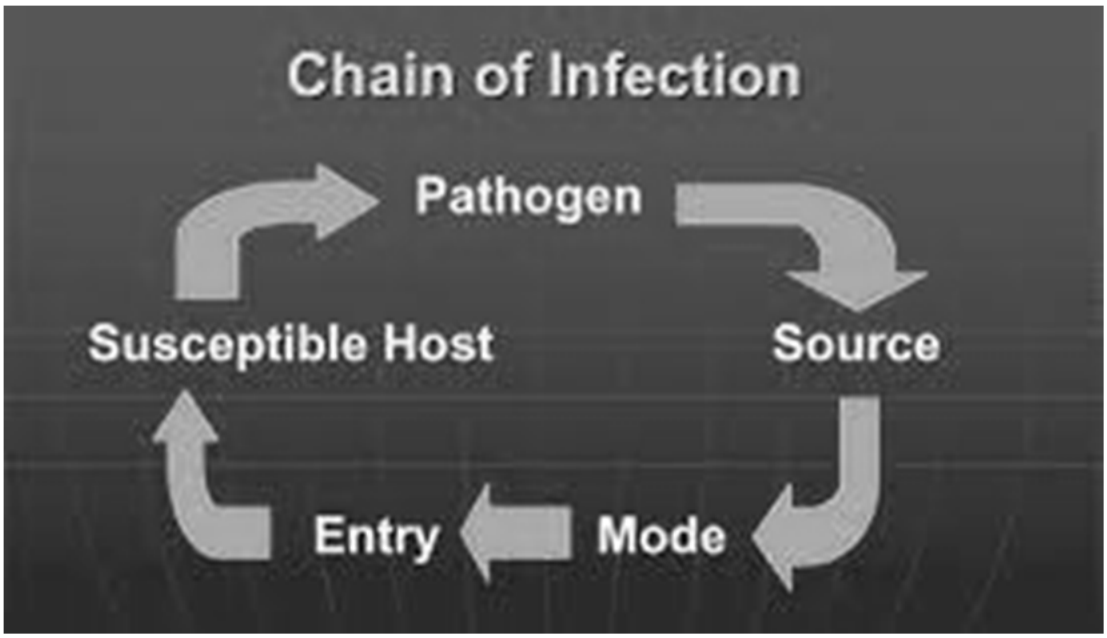


MUSCULO SKELETAL INFECTIONS[8,14]:

1) Infected wounds involving the bone and surrounding structures
2) Pyogenic arthritis
3) Compound fracture elsewhere
4) Chronic osteomyelitis
5) Crush injury of the tissues

INFECTION CHAIN

The infection spread by following way which was illustrated below. The pathogen from the external environment enters to the body through the wound present in the body and also from the internal environment such as deep seated infection like osteomyelitis , pyogenic arthritis and soft tissue lesions like degloving injury and crush injury[12].Chroniclly debilitated patients, immunocompromised patients, diabetic patients are more prone to get infection[11].

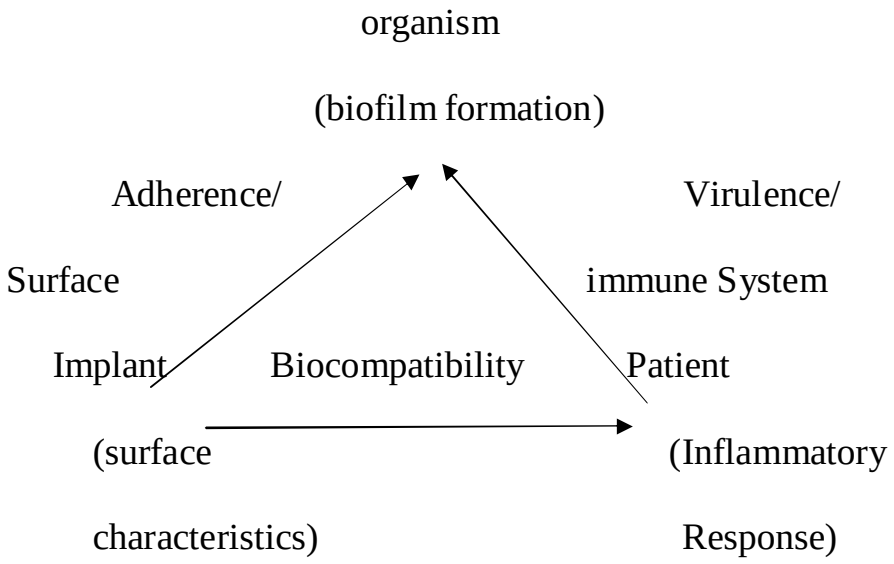


IMPLANT ASSOCIATED INFECTIONS

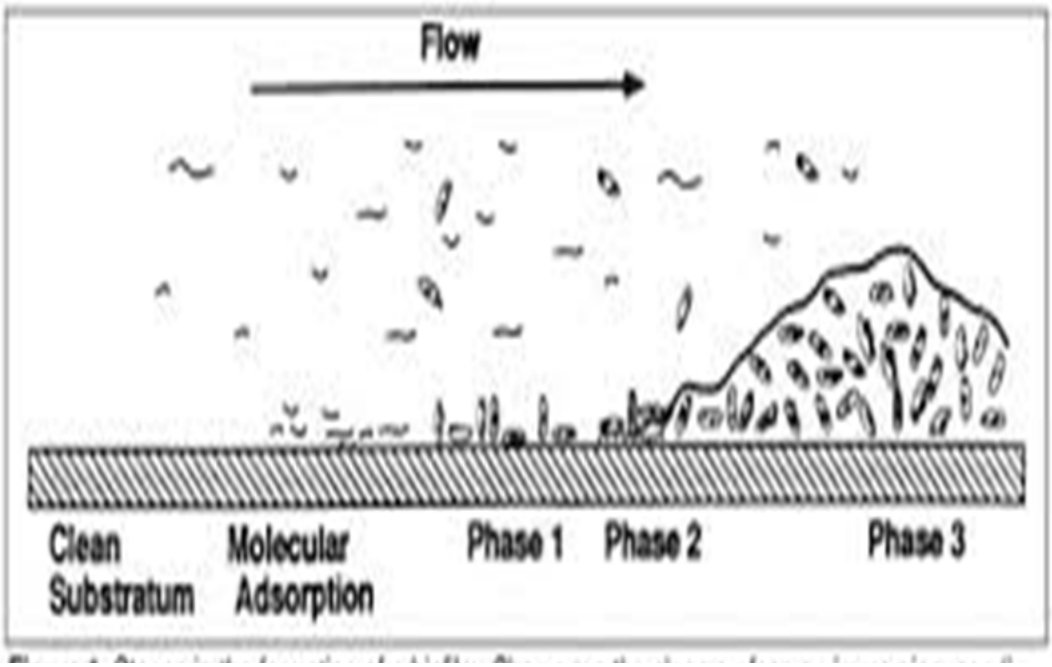
Implant infection may occur at the time of procedure or from the distal extremity infective focus such as chronic osteomyelitis, pyogenic arthritis and infected wound .Operative sites are followed for 30 days for the development of SSI[11,12].

A significant number of people are affected by biofilm infections which develop on orthopaedic devices implanted in the body such as artificial joints and plates, nails. When implanted material becomes colonized by microorganisms, a slow developing but persistent infection results.

Relationship between the organism, the implant and the patient in the pathogenesis of implant related infections[11,14]:



SLIME (BIO FLIM) LAYER



BIO FILM – STEPS OF PRODUCTION[11,14]

Phase 1 : Bacterial Adhesion

Phase 2 : Bacterial Growth & EPS production

Phase 3 : Mature biofilm formation

BIOCHEMICAL & MICROBIOLOGICAL EVALUATION

LABORATORY STUDIES

Infection is always an inflammatory and an immunological phenomenon. Hence the parameters of inflammation and their positive predictive value, specificity and sensitivity are paramount in estabilishing an infective foci annexed below at Meyer et al[9].

A study conducted by Meyer et al had inferred the following,

Meyer et al	C reactive protein	Erythrocyte sedimentation Rate	White Blood cell count
Sensitivity	100	78	21
Negative predictive value	100	98	96
Specificity	95	38	76
Positive predictive Value	48	4	3

It gives the significance of inflammatory markers for infection both pre operatively and post operatively.

Number of positive.tests*	Prob infection
0	19.6%
1	18.8%
2	56.0%
3	100%

Elevation in Total Leukocyte Count, Erythrocyte Sedimentation Rate and C Reactive Protein indicates inflammation . If all the three tests are positive , the possibility of getting infection is more than getting

infection when one or two test positive. Elevated value of C Reactive Protein after 96 hours is predictive of a septic complication[9,33,34].

Dead and dying cells release chemical factors which cause the liver to produce C Reactive Protein.

C Reactive Protein is used to monitor early detection of post operative infection and provides prognosis of the treatment. Bernard et al described that C Reactive Protein was used to detect the early post operative infection after hip fracture surgery[1,29,35].

The CRP levels were measured using semi-quantitative latex agglutination method because it is rapid, less expensive and readily available method, as compared to other quantitative methods[33,34,35].

CRP estimation was done semi- quantitatively using CRP tests kits with reagent sensitivity of 6µg/ml. Serial dilutions of patient's sera were prepared with physiological saline (0.9%) upto a maximum dilution of 1:64. The last dilution of serum with visible agglutination was considered to be the CRP titre of the serum. The CRP concentration was then calculated by multiplying dilution titre with regent sensitivity. Data so obtained was analysed and correlated with the clinical and haematological findings to draw appropriate conclusions[33,34,35].

Consistent marked rise of CRP levels from day 1-3 followed by its equally sharp and consistent decline confirms it to be a very sensitive indicator of tissue trauma with a short half life. In contrast, rise of ESR, TLC and temperature was observed to be slow, reaching its peak on variable days (day 3-5) followed by a slow decline, indicating their poor sensitivity in respect of tissue trauma[33,34,35].

Persistent rise of CRP level beyond third day or any subsequent rise in CRP level was consistent with a septic complication in the patient. CRP was therefore observed to be a sensitive and dependable indicator of orthopaedic sepsis from orthopaedic trauma or surgery . Hence CRP was superior to ESR, TLC count and the diagnosis based on clinical signs, for early diagnosis of postoperative infection[33,34,35,36] .

Along with CRP, ESR and TLC monitoring were also done to assess their natural response to the tissue trauma and as to whether they can also be used as indicators for subsequent septic complication[33,34,35].

Elevated C Reactive Protein after 96 hours of surgery indicates the infection at the operated site from the distant infective focus. After one month of surgery, measurement of C Reactive Protein value should be done to detect any underlying infection . In case of implant involved, surveillance is extended for one year. Serial monitoring of C Reactive Protein , wound swab culture with appropriate antibiotics and regular

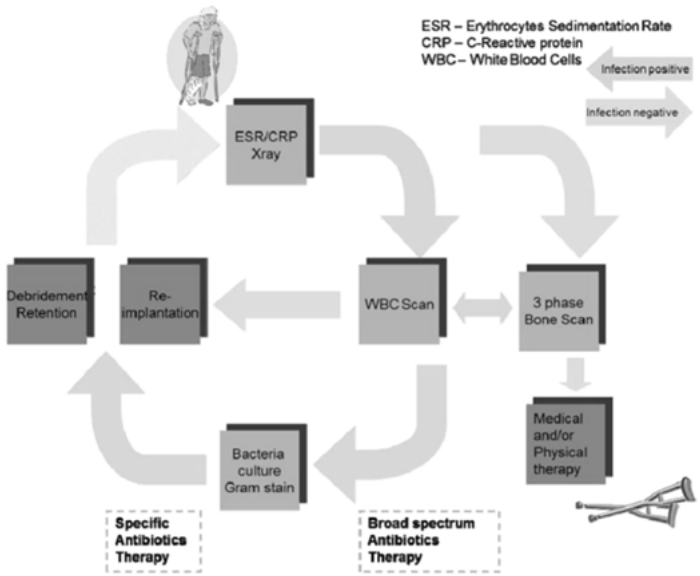
supervision of wound with clinical signs and symptoms are to be done at regular intervals throughout the year[1,29,33,34].

The below illustrated table describened the basic difference between ESR & CRP

Laboratory Test	Levels	Interpretation	Cause
ESR	Normal: men 3 mm/h and women 7 mm/h Rates increase with age	An anti-inflammatory focus has been present for at least several days somewhere in the body, including the CNS	Fibrinogen levels go up in the serum, which causes red cells to clump
hs-CRP	Normal: <1 mg/L	Elevated CRP indicates an active inflammation somewhere in the body, including the CNS. It has caused cellular death and dying within the past 24 hours	Dead and dying cells release chemical factors, which cause the liver to produce CRP

Patient with C R P level less than six (< 6) indicative of no active inflammation and patient can be taken up for any orthopaedic surgical management. Patient with C Reactive Protein level more than six (> 6) indicative of active inflammation in process. So that the patient is not fit for any surgical procedure[9,33,34,35,36].

This diagram shows logarithmic approach of the management with the help of biochemical markers :



The possible ways of treatment has been illustrated in the above diagram. The above illustrations has shown the importance of biochemical and microbiological aspects. In our institute , excluding W B C scan and 3 phase scan , all other markers obtained in all patients. Since, the negative predictive value of E S R & C R P favours low or no infection rate, we tested all patients for E S R and C R P. Pus Culture and Sensitivity for all patients done at appropriate time[21,22,26,33] .

WOUND SWAB CULTURE & SENSITIVITY

It was done at regular intervals i.e once in 14 days till the wound settled. If initial swab was negative for growth, the test was repeated again. If the second swab was positive, appropriate antibiotics were administered till the clinical improvement of wound [14].

ANTIBIOTIC PROPHYLAXIS

The most important factor in lowering the infection is antibiotic prophylaxis**.** Charnley lowered infection rate from 7% to 0.5% (Charnley et al). Highest blood concentration of antibiotic at time of incision should be obtained. It should be completed within 20 to 60 minutes prior to incision. It should be repeated if surgery lasts more than 2 hours or when patient loses more that 30% of blood volume (1.5L). It should be continued till both surgical site wound & infective foci heals[13,16,17,26].

CEPHALOSPORINS

It is considered by many to be best bactericidal antibiotic**.** It has excellent tissue penetration, rapid (within minutes) and good bioavailability**.** It is a broad spectrum antibiotic. It is active against all skin flora including gram negatives. It does not cover MSSA or MRSE. The dosage of the antibiotic is 1 gram in less than 80 kg body weight patient and 2 grams of antibiotic in **p**atients weighing greater than 80 kg[13,16,17,26].

VANCOMYCIN

It should be administered to patients colonized with methicillin resistant staph aureus. It is not best for methicillin sensitive staphylococcus aureus. It has disadvantage of to be administered over 1 to 1.5 hours and is often times not timed correctly. It does not cover any gram negatives[13,16,17,26].

PERIOPERATIVE ANTIMICROBIAL PROPHYLAXIS

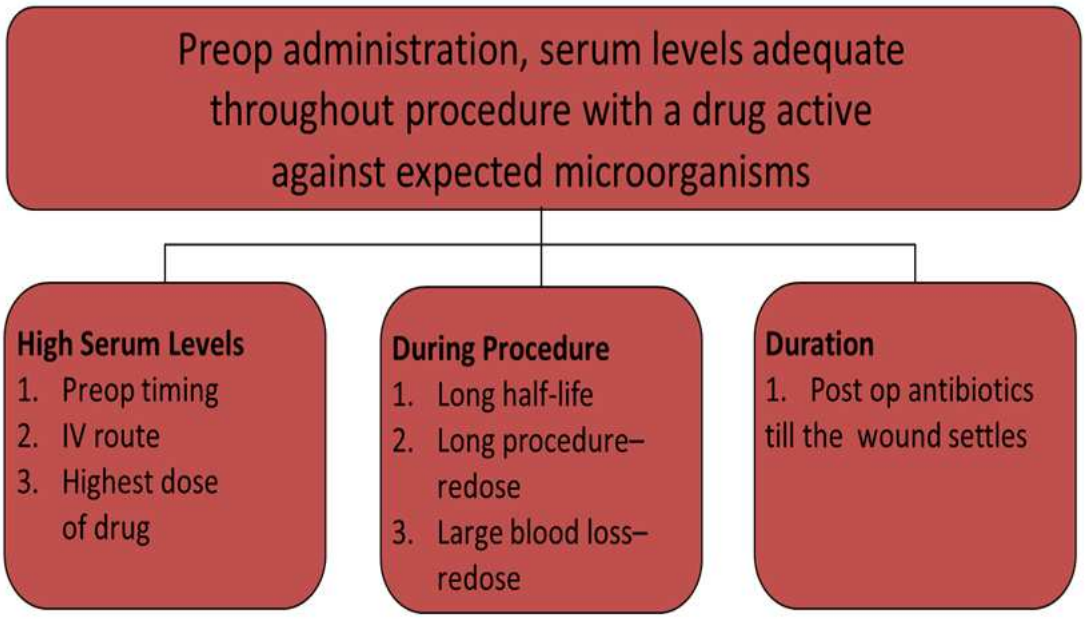
Adult Orthopaedic Surgical Antibiotic Prophylaxis Guidelines
Elective and Closed Trauma Cases

- **Trauma** - this guideline does NOT apply to open fractures
- **Administer prophylactic antibiotics before leaving anaesthetic room** ≤30 minutes prior to surgical incision (antibiotic administration must be complete 10 minutes before inflation of the tourniquet)
- **Additional doses for high risk groups (see dosing table below):**
  - All joint revisions
  - Patients with BMI >30
  - ≥1500mls blood loss – give additional dose early (intraoperatively) to maintain therapeutic levels
- **All suspected infected revision cases should be discussed with a microbiologist in advance, and samples should be taken prior to administration of antibiotics**
- **Check MRSA status before prescribing prophylaxis**
  - Treat unscreened patients, and patients with a history of MRSA as positive unless cleared by infection control
- **Check allergy status**
  - Severe penicillin allergy e.g. angioedema, anaphylaxis or Stevens-Johnson syndrome – avoid all beta-lactams
  - Patients with non-urticarial rash allergy to penicillin may receive cephalosporins in a controlled environment
- **All antibiotic doses are for adults with normal renal function. Gentamicin doses should be rounded to the nearest 80mg**

Procedure	1st choice	2nd choice (mild penicillin allergy)	2nd choice (severe penicillin allergy)	MRSA positive (or increased risk)
Prosthetic joints, complex procedures with major/minor implants and spinal surgery	**Gentamicin 3mg/kg IV + Teicoplanin 400mg IV** Give ONE additional dose of teicoplanin 400mg at 6-12 hours if patient is high risk			
Minor metal work	**Cefuroxime 1.5g IV stat** Additional intra-operative dose if procedure >4hrs Give ONE further dose at 8hrs if **high risk**		**Gentamicin 3mg/kg IV + Teicoplanin 400mg IV** Give ONE additional dose of teicoplanin 400mg at 6-12 hours if patient is high risk	
Surgery without prosthetic device and no clear risk factors for infection	**Prophylaxis is not routinely recommended**			

The guidelines for prophylaxis of antibiotics for surgery has been illustrated in the above mentioned table. The guideline does not apply to open fractures. The recommendations varies with each surgical procedure. Prophylaxis is not recommened for surgery without prosthesis[13,17,18].

Principles of Antibiotic Prophylaxis



PREVENTION OF MRSA

Screening the patients should be mandatory. Hand washing is very effective but compliance is poor. Resistance occurs with commonly used systemic antimicrobials. Isolation of carriers is effective . No proven valve for gowns. Environmental cleaning also not effective in slowing outbreak[12].

The below illustrated table showed the prevention of methicillin resistance staph aureus:

Method	Positives/Negatives
Screening patients	Effective if followed by isolation, cost effective for threshold values
Hand washing	Effective but compliance poor
Antimicrobial topical agents	Mupirocin widely used and effective; resistance occurs
Systemic antimicrobials	Resistance occurs with commonly utilized agents
Separating patients/ward closure	Nurses required to take care of a variety of patients; effective but disruptive
Single room isolation	Variable efficacy; blocks of rooms may be helpful
Pre-identification of carriers and previously infected patients	Effective with total isolation
Gowns	No proven value
Gloves	Effective if changed between patients
Environmental cleaning	Not effective in slowing outbreaks

OPERATIVE TREATMENT

Lambotte's Principles of Surgical Treatment of Fractures

The principles of operative treatment in our study are restoration of articular surface if fracture involving the joint , maintain proper length & alignment, stable fracture fixation, early joint mobilisation. Displaced fractures are managed operatively, particularly those with displaced intra-articular fractures[2]. The age, velocity of injury, condition of local soft tissue envelope, fracture pattern and comorbid conditions are the major determinants for proceeding with operative treatment[29,30].

TYPES OF FIXATION

- Open reduction and internal fixation with Inter locking intra medullary nailing
- Open reduction and internal fixation with plate osteosynthesis
- Open reduction and internal fixation with K wire fixation
- Open reduction and internal fixation with cancellous screw fixation
- Minimally invasive percutaneous plate fixation

The following factors may almost always damage the blood supply and have an immediate bearing on the surgical procedures and its outcome[29,30]:

- The accident: As a result of the displacement of the fragments, periosteal and endosteal blood vessels are ruptured and periosteum is stripped. Furthermore, the implosion damages the soft tissues which are essential for the repair process as well.
- The transportation: If rescue and transportation take place without prior fracture stabilization, motion at the fracture site will add to the initial damage.

- The surgical approach: All surgical exposures of the fracture will invariably result in additional damage, as shown by recent work on ligation of the perforating arteries in the bone diaphysis.

- The implant: Considerable damage to bone circulation may result not only from the retraction and periosteal stripping required to apply an implant, but also from the interface between that implant and the bone.

- Elevated intra-articular pressure reduces the epiphyseal bone circulation, especially in young patients. Implant-associated infections are a formidable challenge.

The surgeon should understand pathophysiology of implant-related infections leads to a logical approach for management. Antibiotic therapy and debridement are the corner stones of treatment.

MATERIALS & METHODS

This is a analytical study in fifteen (15) patients presented with closed fractures with culture proved distant musculoskeletal infective foci elsewhere admitted in Institute of Orthopaedics & Traumatology, Madras Medical College , Rajiv Gandhi Govt General Hospital, Chennai. This study applies strict inclusion and exclusion criteria's with recommended guidelines of treatment.

PERIOD OF STUDY : July 2013 to September 2014

INCLUSION CRITERIA

- Age 14 – 60 years
- Closed fractures with culture proved distant musculoskeletal infective foci such as distant superficial abrasions, deep abrasion, lacerated wound (clean and contaminated) and crush injury.

EXCLUSION CRITERIA

- Age < 14 years & Age >60 years
- Closed fractures without soft tissue injury or distant infective foci elsewhere.
- Co morbid conditions like diabetes mellitus, immune compromised patients, rheumatoid patients.
- Conversion of external fixation to internal fixation.

CLINICAL EVAULATION

Patient presenting with injury to extremities and suspected to have fracture are evaluated after confirming that the general condition of the patient is stable.. Thorough history is mandatory as it gives vital clue to the mechanism of injury, there by we can assess the velocity of injury. History of comorbid illness were elicited, as it is also a significant factor determining the outcome of operative intervention and case selection[29,30].

Different types of wounds produced by various factors[29,30]:

TYPE OF FORCE	TYPE OF INJURY
Sharp, pointed	Incised wound
Blunt	Internal degloving
Twist	Superficial / Deep laceration
Shear	Soft tissue loss /Internal degloving / Abrasion
Combination of forces	Blow out injury / High velocity missile wounds
Crushing	Amputation at the level / soft tissue and bone crush

The infective wound requires necessary surgical intervention with appropriate antibiotics.

On physical examination, signs of fracture such as swelling, tenderness, abnormal mobility, crepitus and deformity are noted.

Systematic palpation to localize tenderness is done. A combination of tenderness, swelling or ecchymosis over the bone, ligament, or joint line suggests an injury. .Evaluation of skin status is done. The other areas of the body were inspected for open wounds, soft tissue contusion and bruises.

Limb edema, palpation of the local skin temperature, development of skin blisters, regional lymph node enlargement were noted. Capillary refill of the involved extremity is monitored periodically in the initial period of injury. Thorough neurovascular examination is carried out. It is necessary to assess the strength generated and not just the apparent motion of the part.

Any injury causing damage to the tissues stimulates local and systemic defense mechanisms which arrest blood loss and prevents infection . Examination of the other bone & joints is done to rule out associated injuries.

RADIOLOGICAL EVALUATION

PLAIN RADIOGRAPHS

The initial radiographic evaluation consists of standard AP, true lateral radiographs of the injured area. Full-length images of the injured extremities complete the radiologic examination of the injured area and are used to diagnose more proximal and potentially non contiguous fractures.

Additional radiographs include special views to identify and assess articular involvement and anatomic details of fracture[2].

CT SCAN

Standard tomography is helpful in documenting articular surface involvement, fracture communition. Computerized Tomography gives a clear cut idea of the number, size, position and shape of the various fracture fragments. It is important in all cases that are evaluated for open reduction and internal fixation. Three dimensional reconstruction cuts adds to more details and helps in better understanding of the fracture morphology[2].

MRI SCAN

This investigation provides excellent soft-tissue contrast resolution, has proved to be superior to CT for evaluation of soft tissue structures around fractures particularly at joint areas. The pathologic conditions of the ligaments and nerve entrapments are demonstrated clearly, so that appropriate treatment can be planned[2].

PROTOCOL

Pre operatively, we have done C Reactive Protein, for all patients on the day of admission and serially till the C reactive Protein level becomes our institutional recommended level(<6). Once C Reactive Protein level

has attained our institutional recommended value (<6), we proceed with definite surgical intervention.

Along with C R P, Erythrocyte Sedimentation Rate and White Blood Cells count tests also done for all patients on the day of admission and serially in pre operative and post operative period.

Pre operatively, appropriate antibiotics for the distant culture proved infective foci was given intravenously or orally , based on pus culture & sensitivity was done on the day of admission and every fortnight until clinical improvement of wound was observed. Once the wound was clinically improved, we proceed with operative management once we attained C Reactive Protein value less than < 6.

For surgical prophylaxis, prophylactic antibiotic coverage includes antibiotic based on wound swab (culture & sensitivity) & additional one more broad spectrum antibiotic which covers both Gram +ve and Gram – ve group of bacteria is given 30 minutes before skin incision to attain maximum concentration at the time of incision. Intra operatively, one additional dose of same antibiotic should be given if the duration of surgery is longer than 2 hours and the amount of blood loss is more than 1500ml.

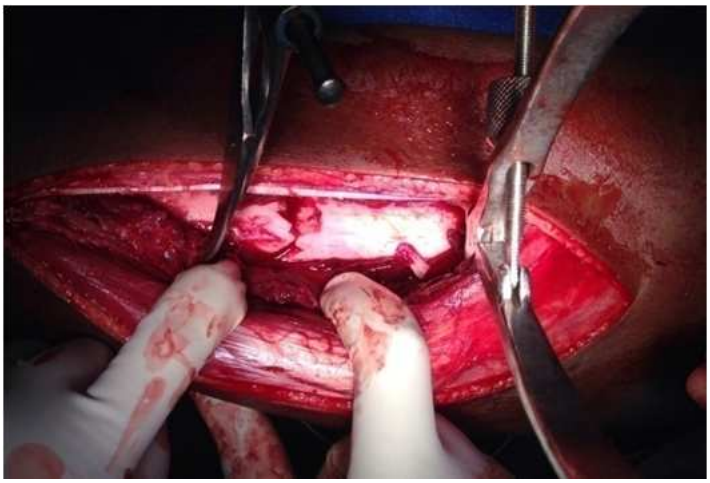
Irrespective of the culture proved wound status, surgical intervention in the form of internal fixation was done when the C Reactive Protein

value is less than six (< 6). Internal fixation of fractures have been done with plate osteosynthesis or intramedullary implants.

IMPLANTS USED FOR INTERNAL FIXATION

- Intramedullary interlocking nail with locking screws
- Dynamic Compression plate (Broad / Narrow / Asian)
- Locking compression plate osteosynthesis
- 1/3 Tubular plate osteosynthesis
- Reconstruction plate osteosynthesis
- Buttress Plate osteosynthesis
- Krishner wire fixation
- Cancellous Screw fixation

Fracture fixation by open surgical methods is done to obtain anatomical restoration of articular surface & acceptable reduction of the fracture fragments[2].



C reactive protein value will be elevated in the immediate post operative period because of the surgical trauma[9,19,20]. After 4th day of surgery, C reactive protein becomes normal. Hence we followed up the patients with C Reactive Protein values on 4th day and at the end of 4th week to rule out any infection in operated site. If the C Reactive Protein value is less than recommended normal value (< 6), possibilities of infection can be ruled out.

If it is found to be elevated (>6), the focus of infection should be identified by clinical, biochemical , microbiological evaluation of aspirated material at the operated site and drain tip culture and sensitivity with radiological evaluation. Any significant increase or decrease in the CRP values were noted.

After surgery, combination antibiotic therapy (which was given just before surgery)is continued for two weeks intravenously. After two

weeks of intravenous antibiotic therapy, one week of broad spectrum oral antibiotics were given to necessary cases. On the 2nd post operative day , swab from infective foci and surgical site were sent for culture and sensitivity , and the results were analyzed for the similarity of the organisms.

As pain is one of the cardinal signs of inflammation and infection , visual analog score was used to evaluate the pain outcome at 1st and 3rd month, 6th month in our study.

During the follow up, patient's surgical site, infective focus site & radiological signs of union by X ray and functional outcome were analyzed and interpreted at 1st , 3rd & 6th month for outcome analysis.

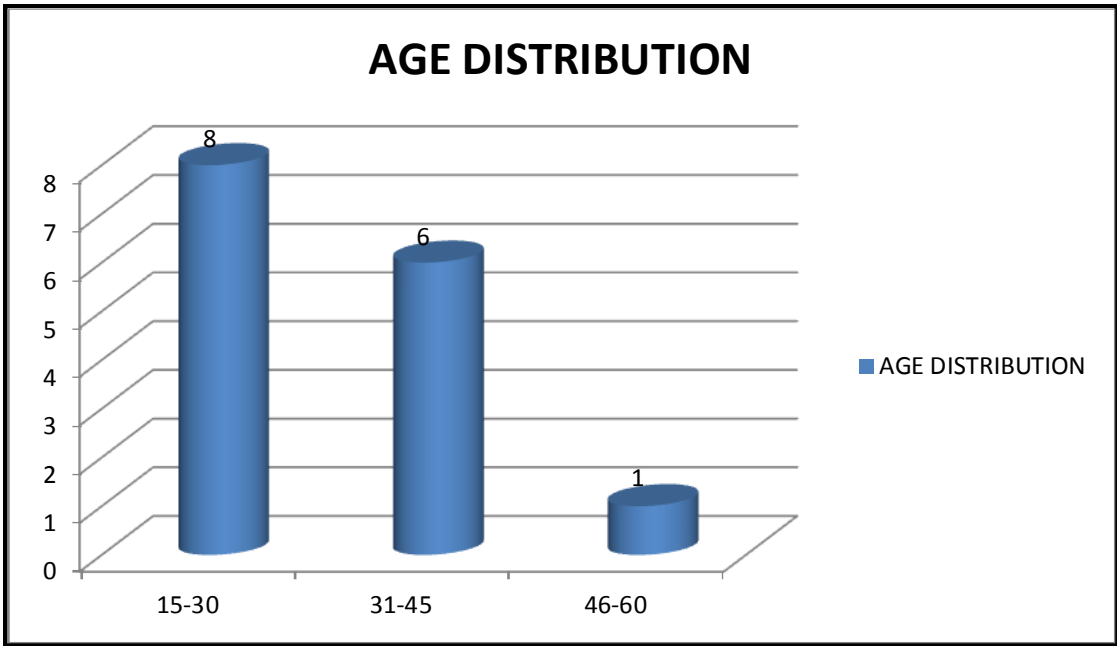
RADIOLOGICAL SIGNS OF UNION

- Restoration of cortical continuity (look for healing on 4 cortices - AP and lateral views);
- Loss of distinct fracture line;
- Presence of callus
- The late radiographic signs of bony union are the reforming of the normal trabecular pattern, obscuring the fracture line and remodeling and restoration of the continuity of the medullary cavity and cortex.

TREATMENT METHODOLOGY IN OUR STUDY

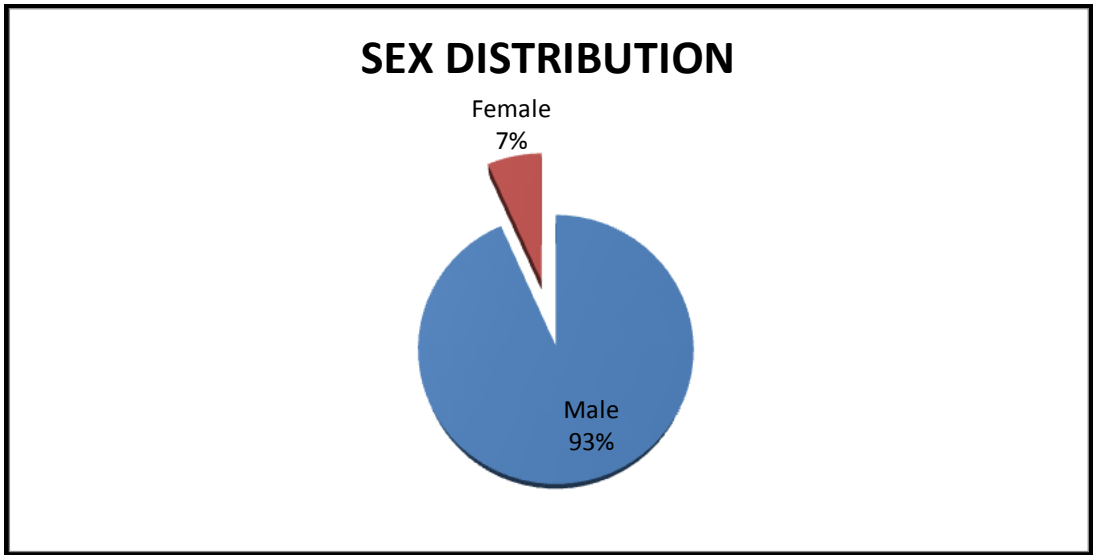
- Fracture : Appropriate radiological investigations
- X Ray, CT Scan, MRI
- Wound : Pus Culture & Sensitivity
- Antibiotics whenever required
- Laboratory : CRP, ESR , Differential Count , Total Count
- Co morbid conditions Evaluation
- Proper pre operative planning
- Better intraoperative soft tissue handling
- Surgical management in the form of plate osteosynthesis, Interlocking intramedullary nailing
- Identification of early complication
- Post op inflammatory marker evaluation whenever required
- Good antibiotic coverage if required
- Regular follow up of the patient
- Anticipation of late or delayed complications

RESULTS



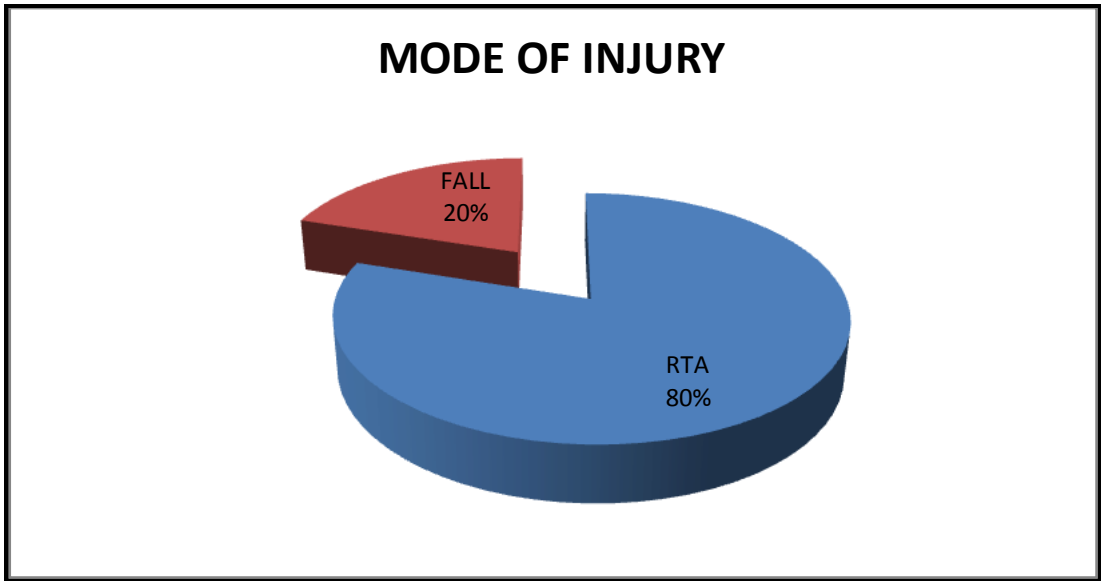
S No	Age	No of Patients
1	15-30	8
2	31-45	6
3	46-60	1

In our study , younger age group patients (8) are more than middle age group(6) and old age group patients(1)



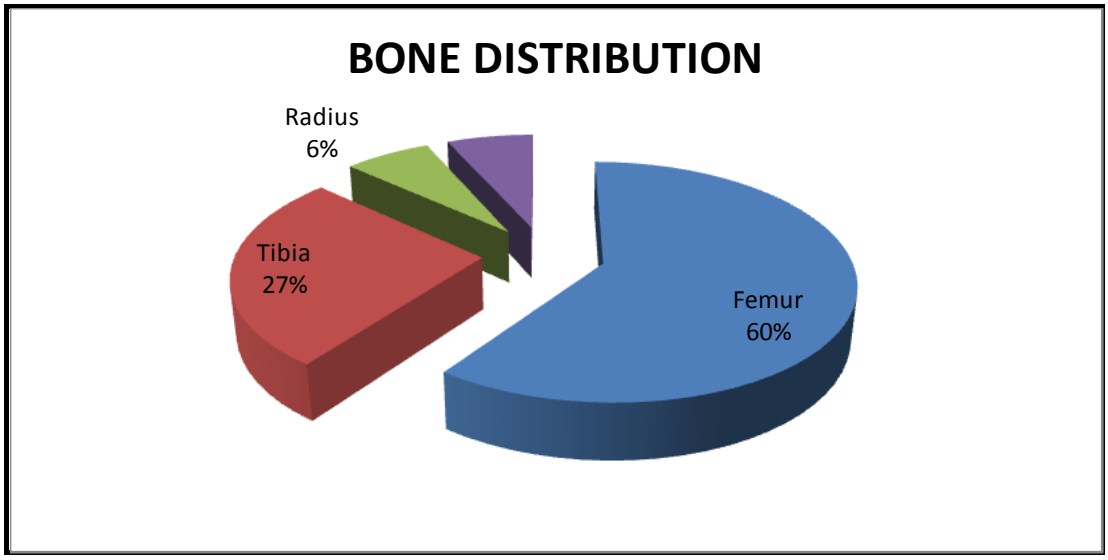
S No	Sex	No of Patients
1	Male	14
2	Female	1

In our study , Male patients (14) are more than female patients (1)



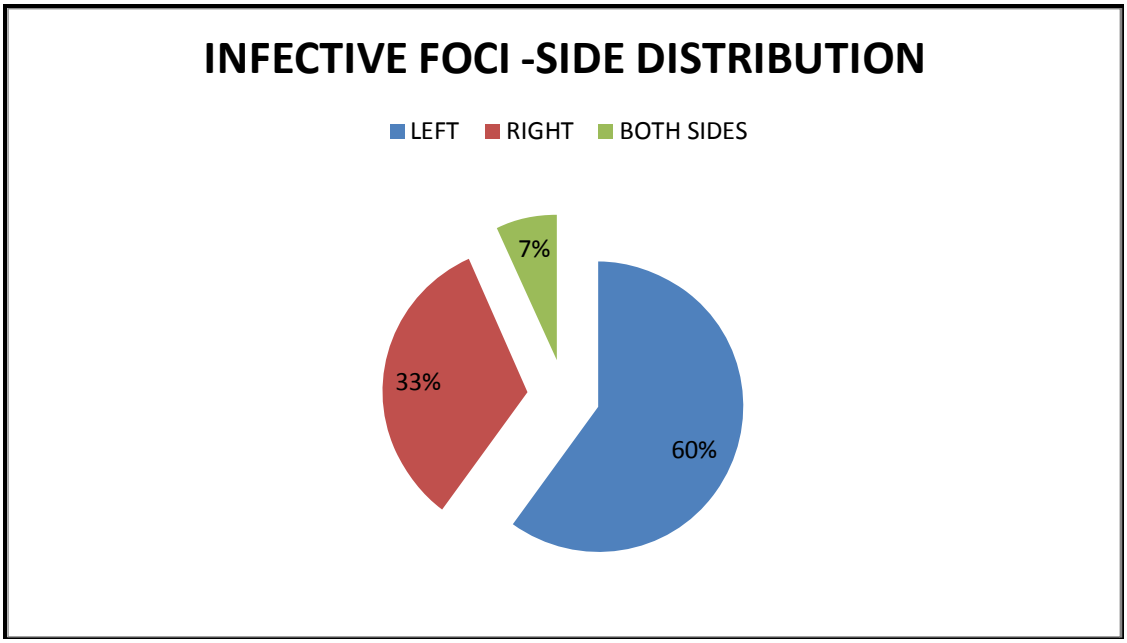
S No	Mode of Injury	No of Patients
1	RTA	12
2	FALL	3

In our study , Road Traffic Accident is the most common cause of injury.



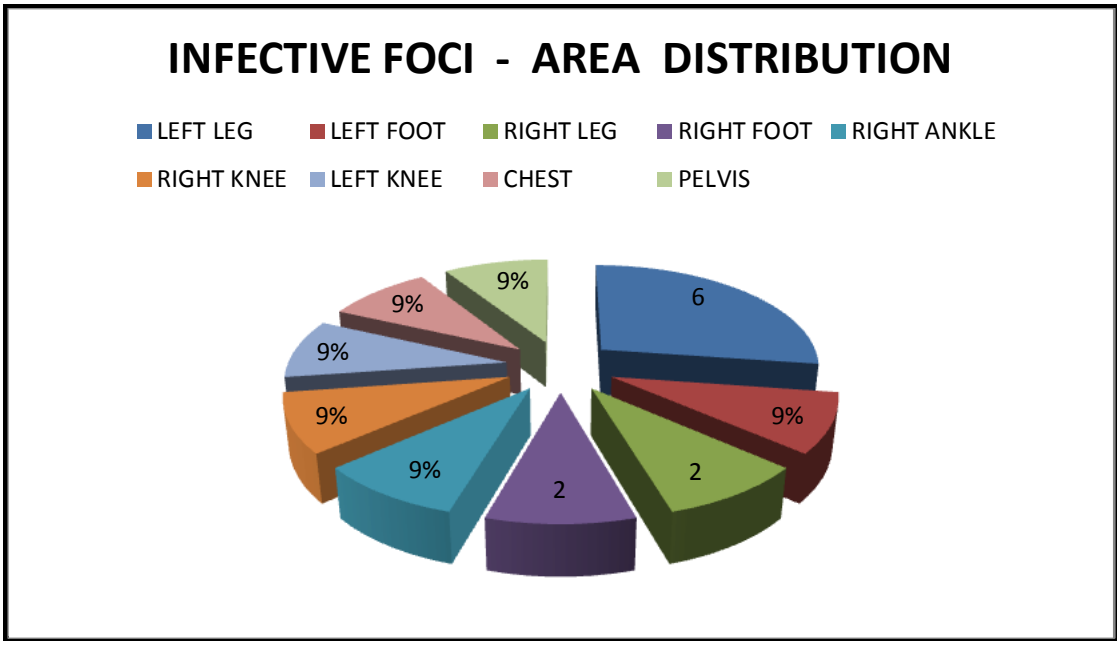
S No	Bone Involved	No of patients
1	FEMUR	9
2	TIBIA	4
3	RADIUS	1
4	CALCANEUM	1

In our study, femur was the most common bone involved followed by tibia. According to our study, lower extremities are more commonly involved than upper extremities.

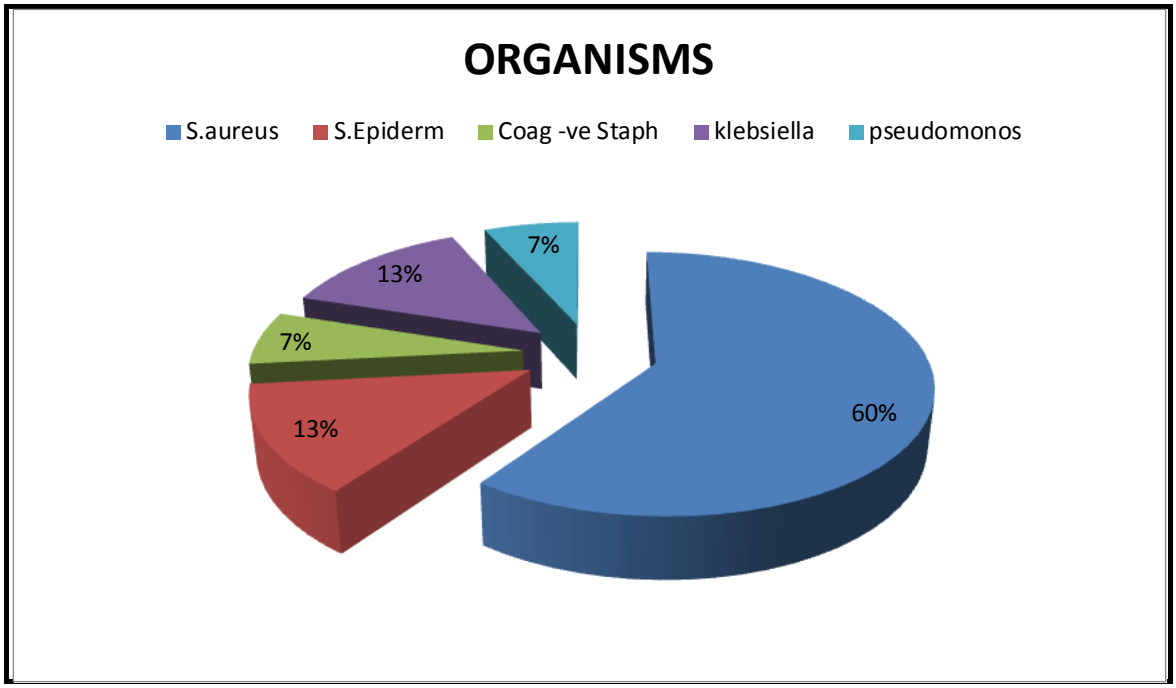


S No	Infective Foci Side Distribution	No of Patients
1	Left	9
2	Right	5
3	Both Sides	1

Our study showed left side was affected more than the right side. Both sides were involved in one patient.



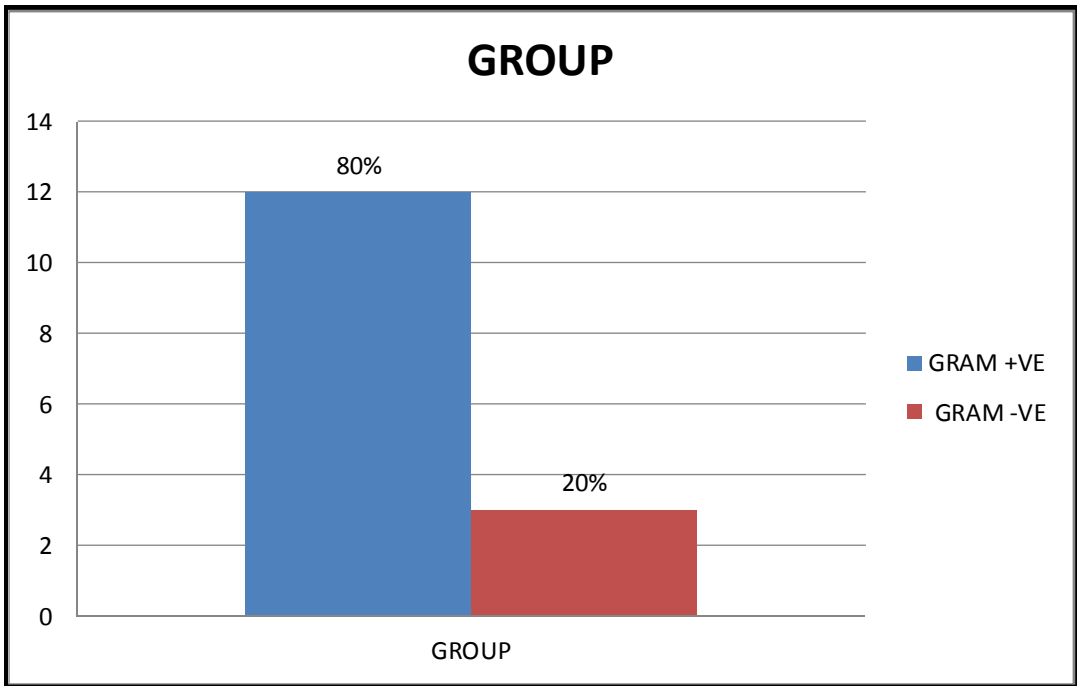
S No	Infective Foci Area involved	No of patients
1	LEFT LEG	6
2	RIGHT LEG	2
3	LEFT FOOT	1
4	RIGHT FOOT	2
5	LEFT KNEE	1
6	RIGHT KNEE	1
7	RIGHT ANKLE	1
8	PELVIS	1
9	CHEST	1



S No	Micro organisms	No of Patients
1	Staph Aureus	9
2	Staph Epidermidis	2
3	Coag –ve Stah aureus	1
4	Klebsiella	2
5	Pseudomonas	1

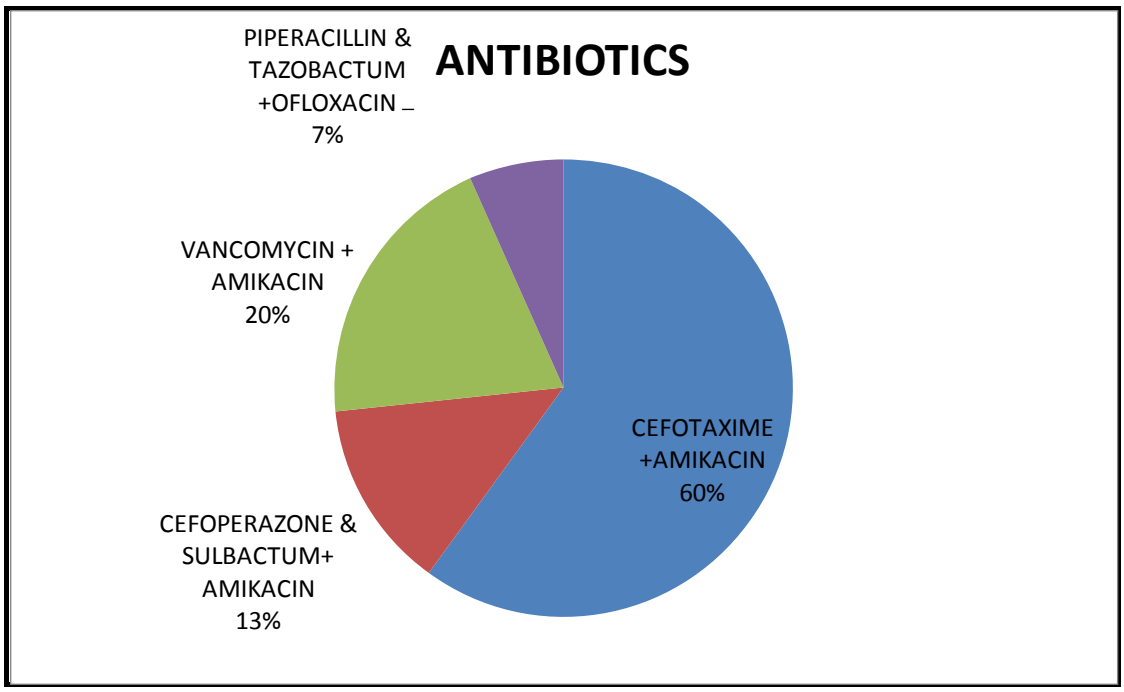
In our study, staph aureus found in nine patients followed by staph epidermidis. Pseudomonas found in one patient.

GROUP DISTRIBUTION



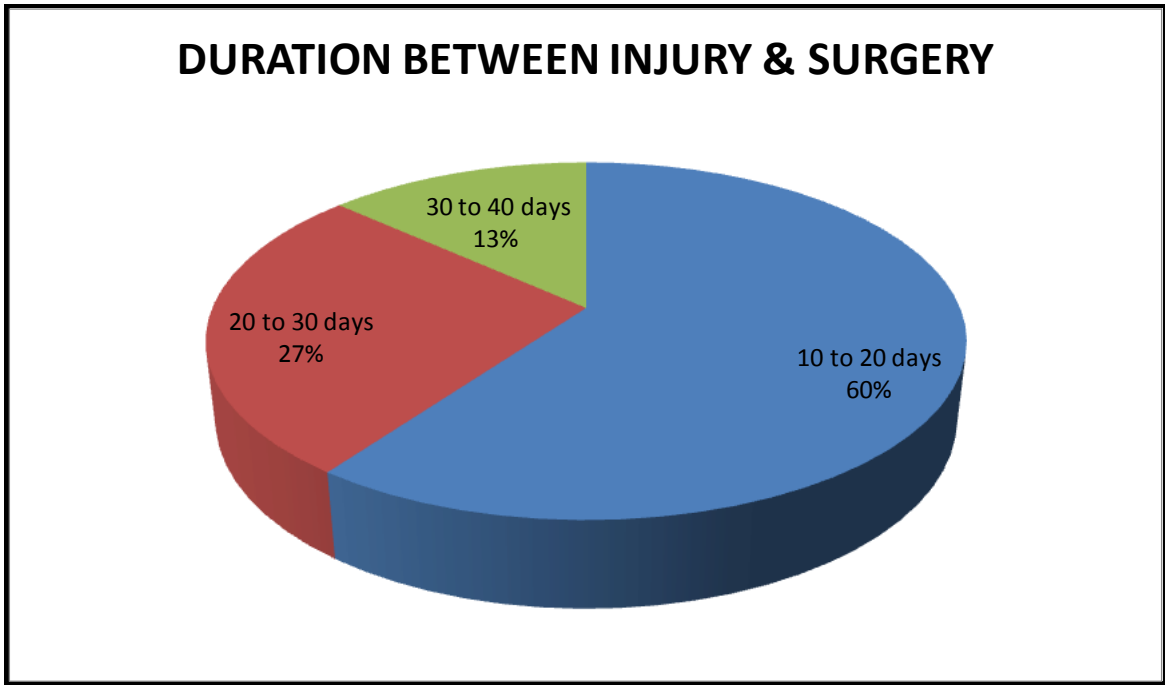
S No	Organisms Group Distribution	No of Patients
1	Gram +Ve	12
2	Gram –Ve	3

According to our study, Gram +ve organisms are commonly seen than gram –ve group.



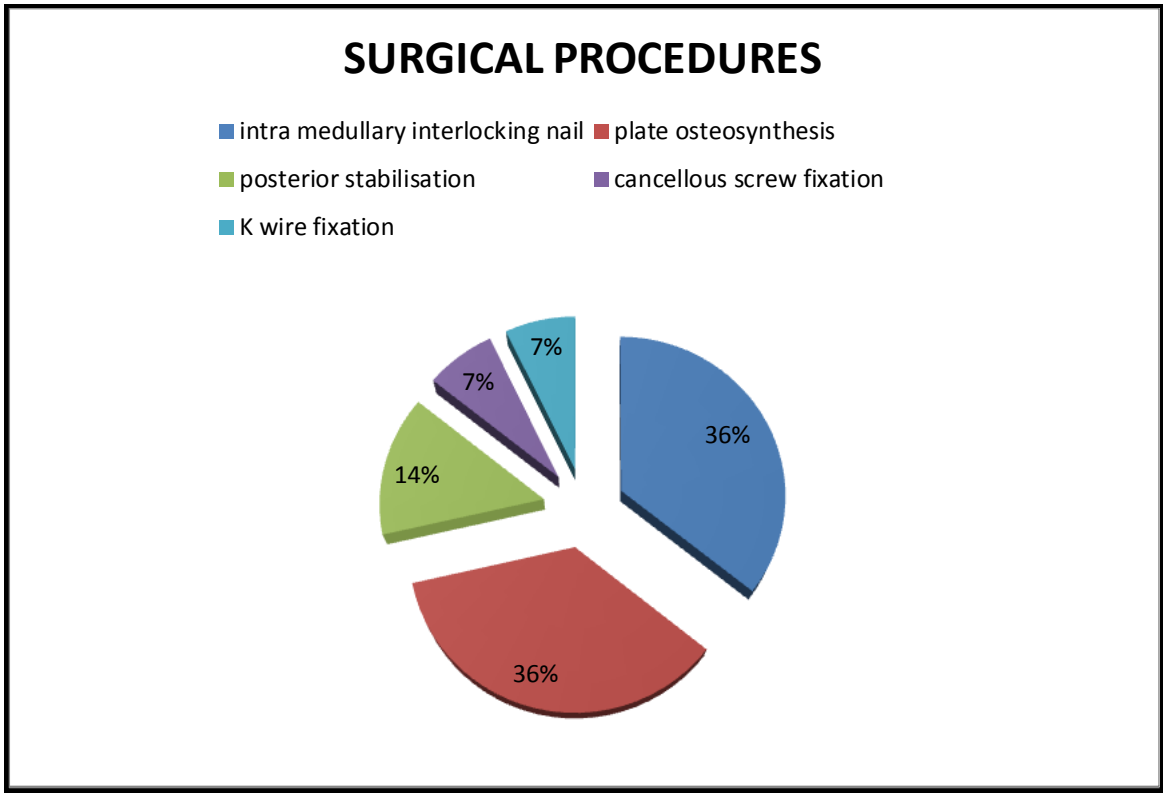
S No	Antibiotic Therapy (as per Wound Swab)	No of patients
1	Cefotaxim + Amikacin	9
2	Cefoperazone & SulBactum + Amikacin	2
3	Vancomycin + Amikacin	3
4	Piperacillin & tazobactum + Ofloaxcin	1

Our study shows cefotaxim and amikacin combination therapy (9) was used most commonly.



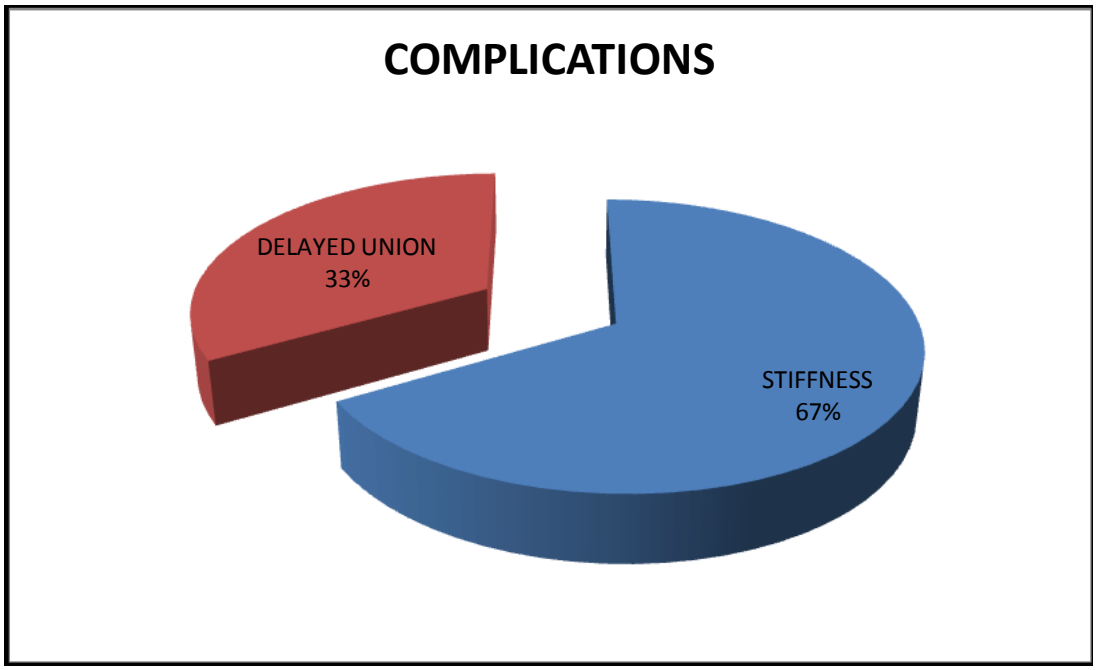
S No	Time interval between injury & Surgery (DAYS)	No of patients
1	11 - 20	9
2	21-30	4
3	31- 40	2

Nine (9) Patients are operated at 11 to 20 days of injury . Four (4) patents are operated at 21 to 30 days after injury. Two (2) patients are operated at 30 to 40 days after injury.



S No	Procedures	Count
1	Intramedullary inter locking nailing	5
2	Plate osteosynthesis	7
3	Posterior Stabilization Spine	2
4	Cancellous Screw fixation	1
5	K wire fixation	1

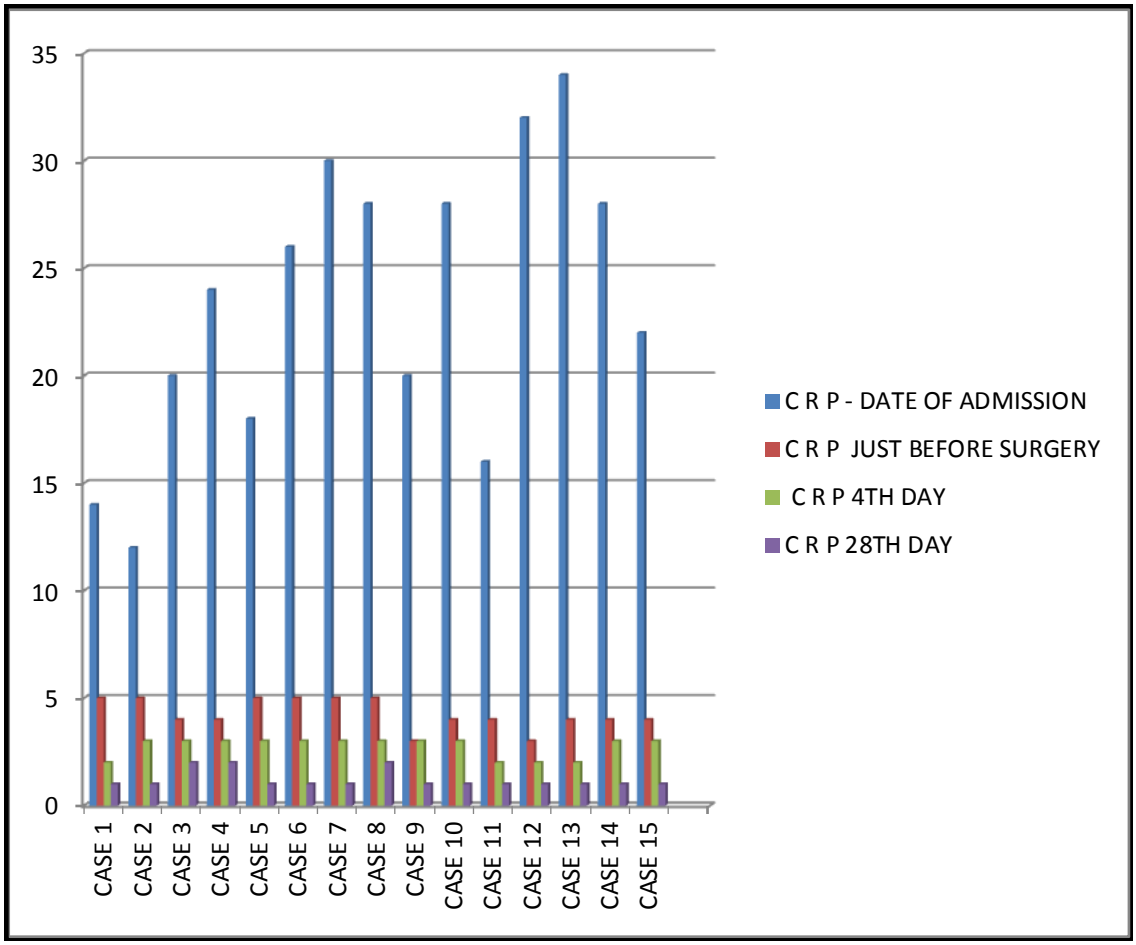
Our study shows Plate osteosynthesis and Nailing are the two commonly done procedures in our institution.



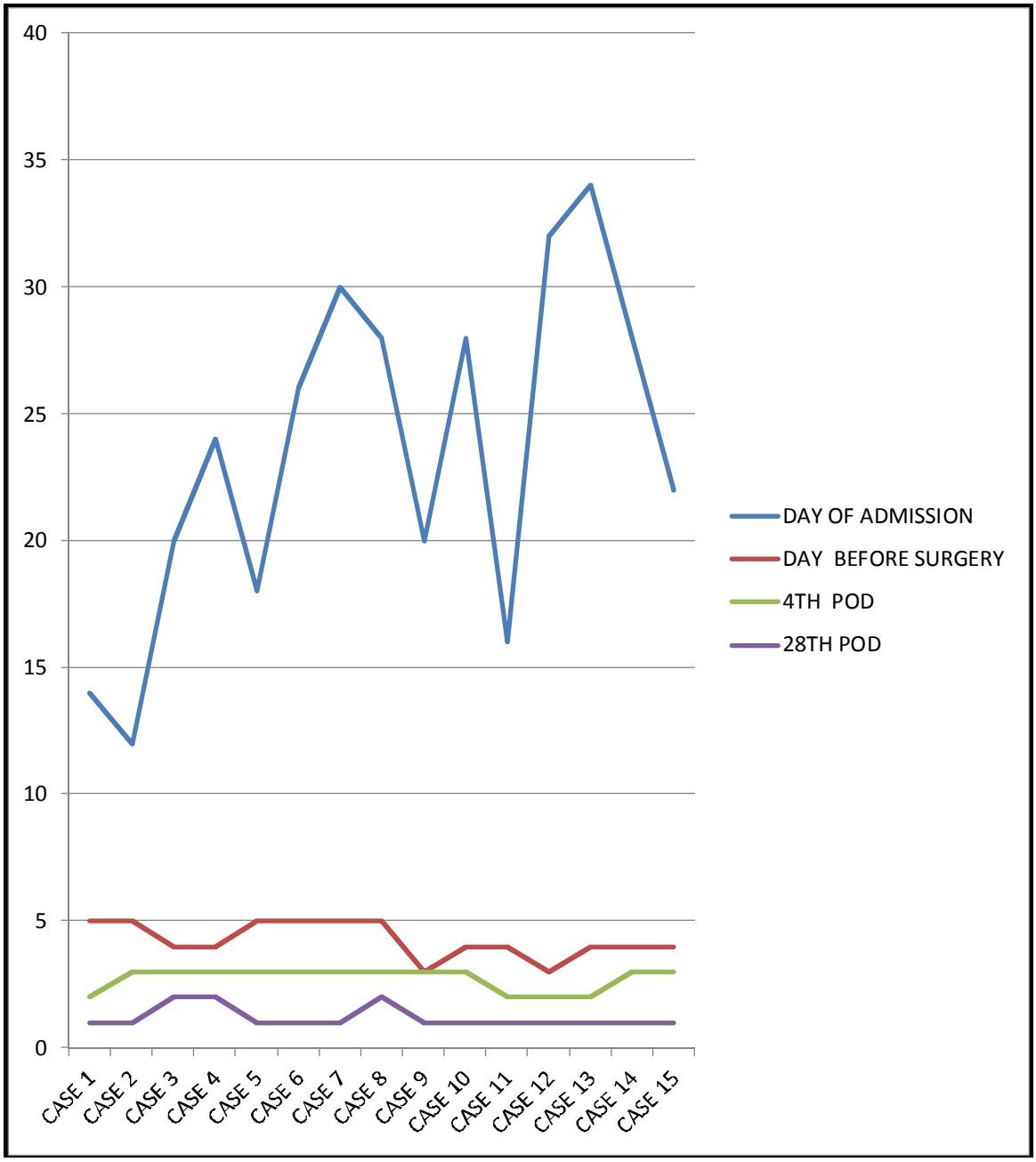
S No	Complication	No of patients
1	Stiffness	2
2	Delayed union	1

Stiffness was found in two patients. Delayed union was seen in one patients.

C REACTIVE PROTEIN VALUES – DIFFERENT INTERVALS



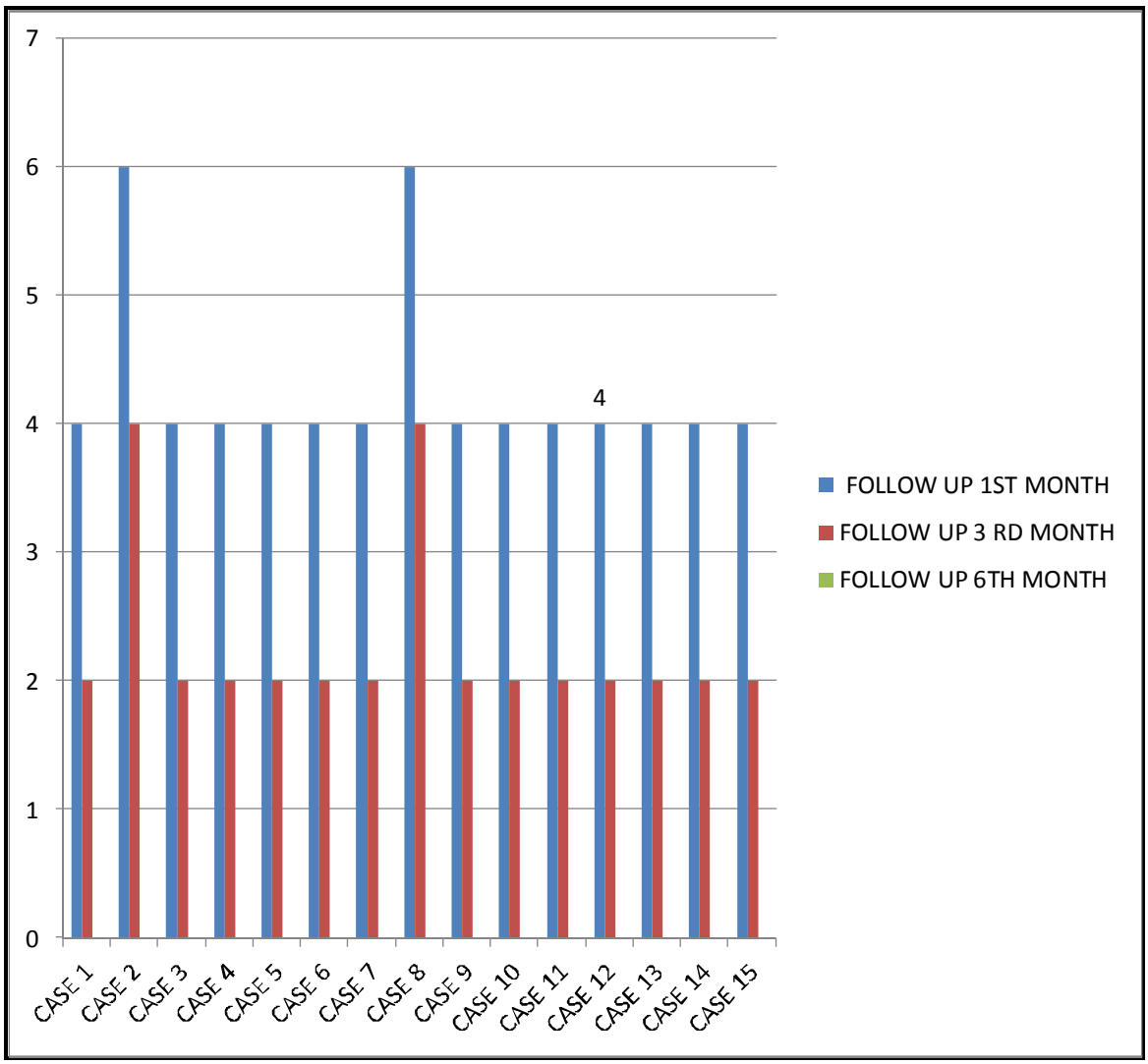
In our study, C Reactive Protein was obtained at the day of admission, just before surgery, 4th POD and 28th POD respectively. Our study pre operative mean value is 23.4, 4.2 at the day of admission and day before surgery respectively. Post operative mean value is 2.73, 1.2 at 4th POD and 28th POD respectively.


40
35
30
25
20
15
10
5
0
CASE 1
CASE 2
CASE 3
CASE 4
CASE 5
CASE 6
CASE 7
CASE 8
CASE 9
CASE 10
CASE 11
CASE 12
CASE 13
CASE 14
CASE 15
DAY OF ADMISSION
DAY BEFORE SURGERY
4TH POD
28TH POD

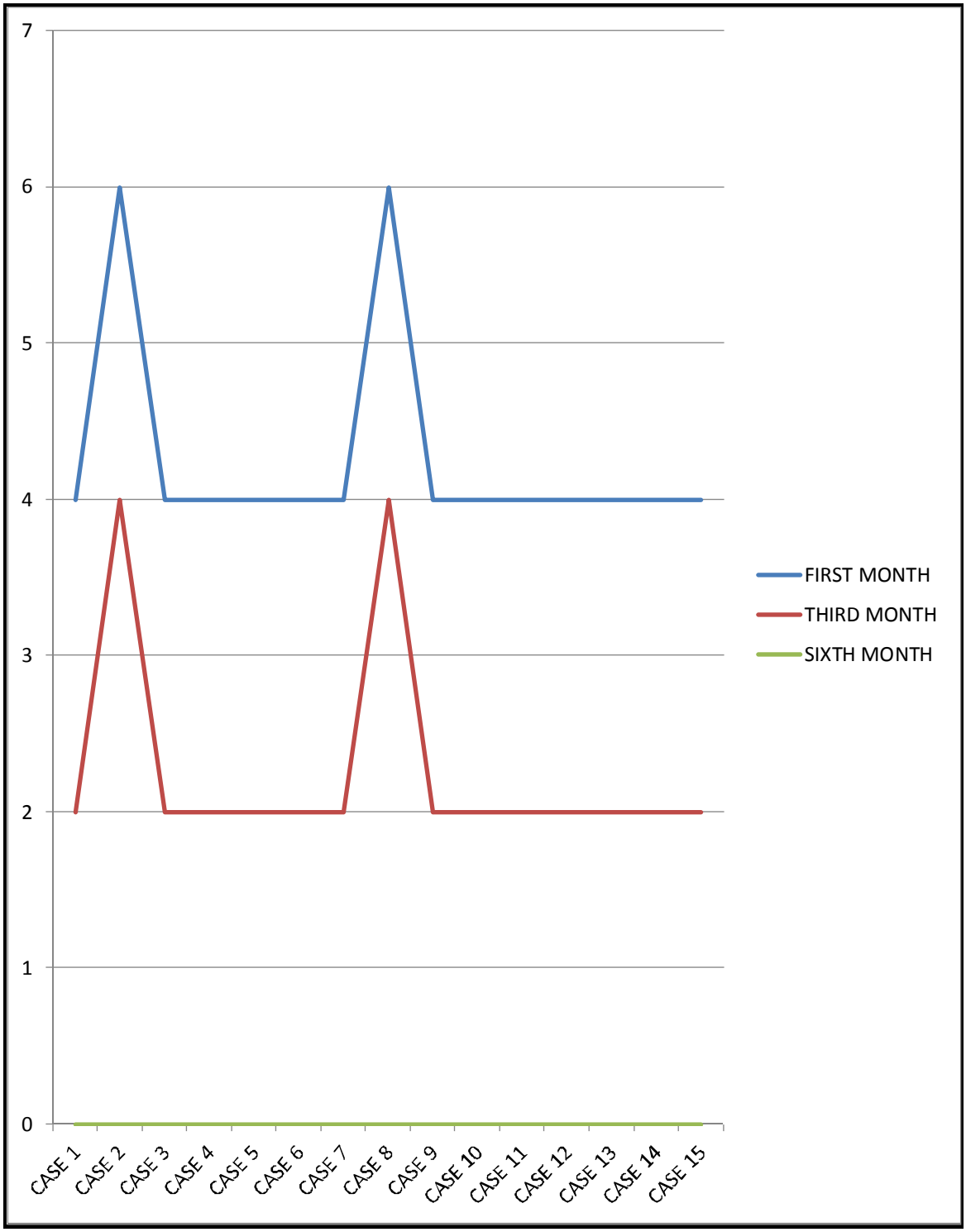
C REACTIVE PROTEIN VALUES – INTERPERTATION

C R P	DATE OF ADMISSION	DAY BEFORE SURGERY	4^{TH} DAY	28^{TH} DAY
CASE 1	14	5	2	1
CASE 2	12	5	3	1
CASE 3	20	4	3	2
CASE 4	24	4	3	2
CASE 5	18	5	3	1
CASE 6	26	5	3	1
CASE 7	30	5	3	1
CASE 8	28	5	3	2
CASE 9	20	3	3	1
CASE 10	28	4	3	1
CASE 11	16	4	2	1
CASE 12	32	3	2	1
CASE 13	34	4	2	1
CASE 14	28	4	3	1
CASE 15	22	4	3	1

VISUAL ANALOG SCALE INTERPERTATION



Visual analog scale showing decrease in values at 3rd month of follow up . None of the patients had pain post operatively and all patients showed zero value at end of the 6th month.


7
6
5
4
3
2
1
0
CASE 1
CASE 2
CASE 3
CASE 4
CASE 5
CASE 6
CASE 7
CASE 8
CASE 9
CASE 10
CASE 11
CASE 12
CASE 13
CASE 14
CASE 15
FIRST MONTH
THIRD MONTH
SIXTH MONTH

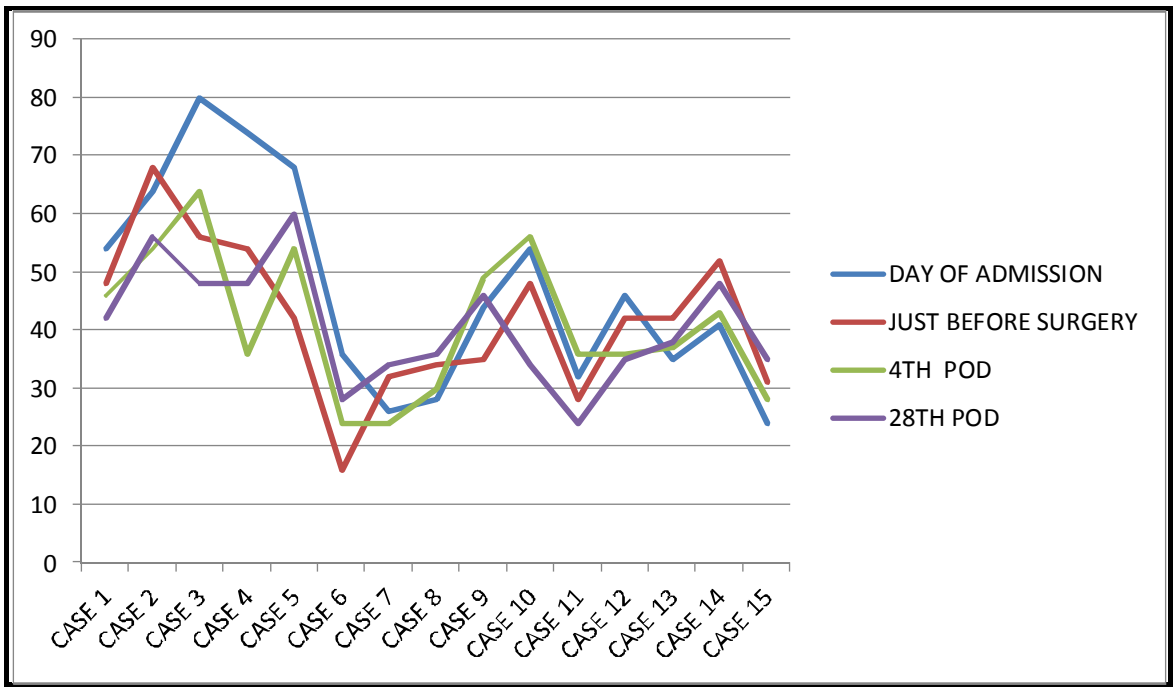
VISUAL ANALOG SCALE INTERPERTATION

V S A	1ST MONTH	3RD MONTH	6TH MONTH
CASE 1	4	2	0
CASE 2	6	4	0
CASE 3	4	2	0
CASE 4	4	2	0
CASE 5	4	2	0
CASE 6	4	2	0
CASE 7	4	2	0
CASE 8	6	4	0
CASE 9	4	2	0
CASE 10	4	2	0
CASE 11	4	2	0
CASE 12	4	2	0
CASE 13	4	2	0
CASE 14	4	2	0
CASE 15	4	2	0

ERYTHROCYTE SEDIMENTATION RATE– INTERPRETATION

S No	ERYTHROCYT E SEDIMENTATION RATE			
	DAY OF ADMISSION	DAY BEFORE SURGERY	4^{TH} POD	28^{th} POD
CASE 1	54	48	46	42
CASE 2	64	68	54	56
CASE 3	80	56	64	48
CASE 4	74	54	36	48
CASE 5	68	42	54	60
CASE 6	36	16	24	28
CASE 7	26	32	24	34
CASE 8	28	34	30	36
CASE 9	44	35	49	46
CASE 10	54	48	56	34
CASE 11	32	28	36	24
CASE 12	46	42	36	35
CASE 13	35	42	37	38
CASE 14	41	52	43	48
CASE 15	24	31	28	35

E S R - INTERPRETATION



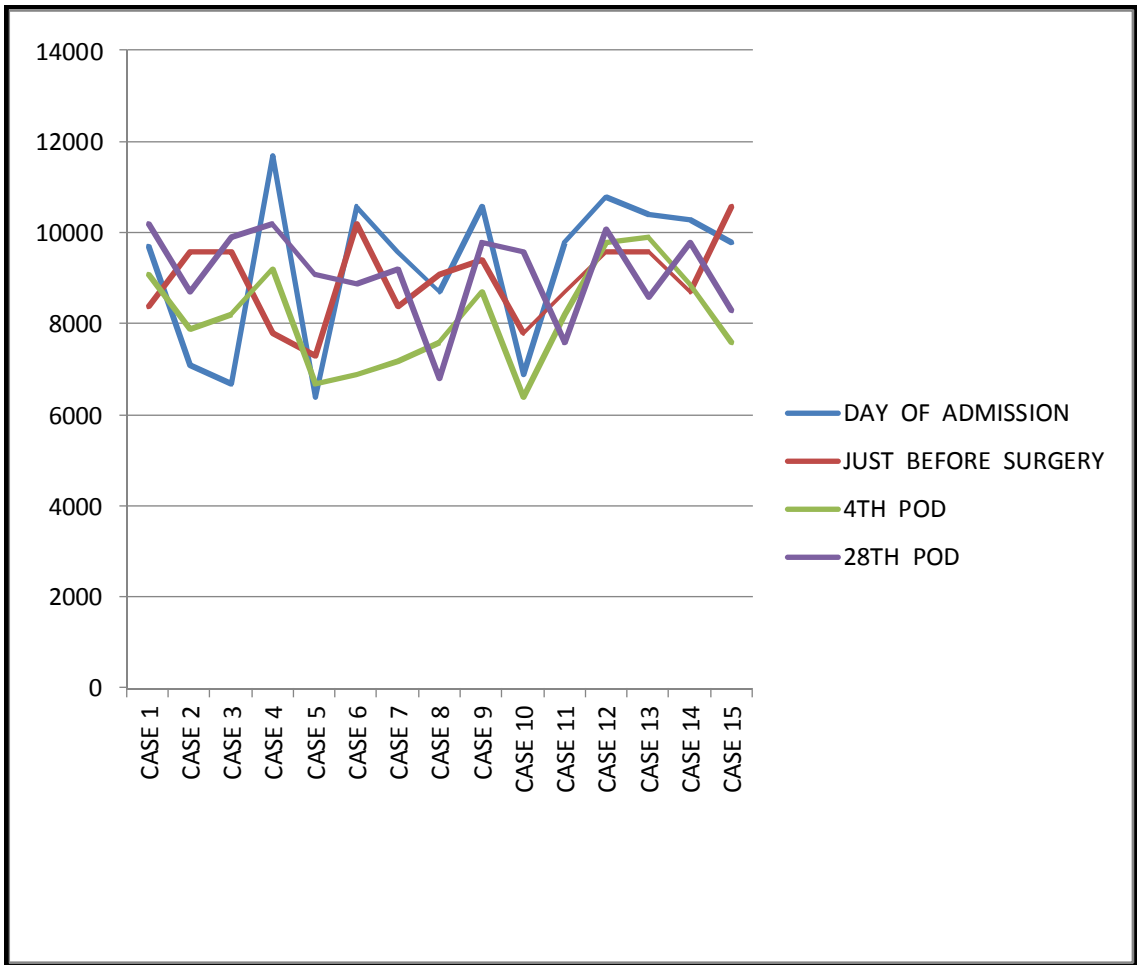
In our study, Erythrocyte Sedimentation Rate and polymorphonuclear cells count were interpreted both pre operatively and post operatively.

The preoperative mean value of ESR at the day of admission is 47.06. and just before surgery is 41.86. The post operative mean value of ESR at 4th POD and 28th POD are 41.13 and 40.8 respectively. It shows that E S R has no significance to detect post operative implant infection or surgical site infection when compare to C R P.

TOTAL LEUCOCYTE COUNT - INTERPRETATION

S No	POLY MORPHO NUCLEAR CELLS			
	DAY OF ADMISSION	DAY BEFORE SURGERY	4^{TH} POD	28^{th} POD
CASE 1	9700	8400	9100	10200
CASE 2	7100	9600	7900	8700
CASE 3	6700	9600	8200	9900
CASE 4	11700	7800	9200	10200
CASE 5	6400	7300	6700	9100
CASE 6	10600	10200	6900	8900
CASE 7	9600	8400	7200	9200
CASE 8	8700	9100	7600	6800
CASE 9	10600	9400	8700	9800
CASE 10	6900	7800	6400	9600
CASE 11	9800	8700	8200	7600
CASE 12	10800	9600	9800	10100
CASE 13	10400	9600	9900	8600
CASE 14	10300	8700	8900	9800
CASE 15	9800	10600	7600	8300

T L C - INTERPRETATION



It shows that Total Leucocyte Count (T L C) has no significance to detect post operative implant infection or surgical site infection when compare to C R P.

OBSERVATIONS AND RESULTS

- In our study, outcome analysis of internal fixation for fifteen (15) patients were analyzed.
- Eight (8) patients belong to 15-30 years, six patients are in between 31-45 years, one patient belongs to 46-60 years.
- Fourteen (14) patients are males & one (1) patient is female.
- Femur is the most commonly involved bone (9), followed by tibia (4).
- Left side was involved in 9 patients & right side was involved in 5 patients. One patient had infective foci on both sides.
- Infective foci is most commonly seen in leg segment (8 patients) followed by foot segment (3 patients).
- Staphylococcus aureus was seen most commonly (10 patients). Both staphylococcus epidermidis & klebsiella were found in two(2) patients each. Pseudomonas is seen in one(1) patient.
- Out of ten patients with staphylococcus aureus, three(3) patients had methicillin resistant staphylococcus aureus (sensitive to vancomycin) one patient had coagulase negative staphylococcus aureus.

- Twelve (12) patients had Gram +ve & three (3) patients had Gram – ve organisms.

- Cetotaxime with amikacin combination antibiotic therapy was the most commonly given therapy (9 patients) , followed by vancomycin with amikacin combination therapy (3 patients).

- Organisms found in infective focus are not seen at surgical site, which was confirmed by drain tip swab culture & sensitivity after 2^{nd} POD.

- Post operatively all patients showed CRP value < 6 at 4^{th} POD & end of the 4^{th} Week(28^{th} day).

- Two patients had minimal discharge at surgical site. The discharge was serous discharge which showed no growth of organisms by culture & sensitivity.

- No patients had post operative surgical site infection early or late in our follow up period.

- It shows, out of fifteen (15) patients, two (2) patients had stiffness in early post operative period. They were subjected to physiotherapy and attained near normal range of movements. All other patients had full range of movements.

- ❖ According to our study, the presence of infective foci in the same limb or distant foci has no significance.

- ❖ Considering pain as one of the indicators of infection, except 2 patients had pain with a Visual Analog Scale of 4, all other patients were pain free with Visual Analog Scale of 2 at the end of the third month. All patients had a VSA of zero at the end of 6 months.

DISCUSSION

C-reactive protein is an acute phase protein and has been considered a non specific indicator of tissue insult. It is, therefore, important to know the natural response of CRP after accidental or surgical trauma before its value can be used to diagnose septic complication in procedures following orthopaedic trauma[35,40,41].

From the previous study conducted by Meyer et al in 1999, the sensitivity and negative predictive value were 100% and the specificity was 95%[9]. In our study, case selection for surgery was made when the pre op C Reactive Protein value < 6 from the mean C Reactive Protein value of 23.4 at the day of admission. We observed no post operative infection in any of the 15 cases internally fixed with culture proved distant foci elsewhere in the body.

The former observation is evident from the 4^{th} and 28^{th} POD C reactive protein value < 6 with no clinical signs of infection in all fifteen cases.

When comparing the Meyer et al study[9], our study also showed 100% specificity and 100 % negative predictive value for C reactive protein both pre and post operatively.

Along with C reactive protein, erythrocyte sedimentation rate and white blood cell count gives additional information regarding the probability of infection in the pre operative as well as post operative period.

Aktuelle Traumatol et a1[40,41,42]. 1994 study indicates that the determination of two CRP-levels with a short interval in case of a clinically suspected infection is another, meaningful criterion in making a decision for an further necessary management. In our study, the pre operative and post operative CRP values at shorter interval were used to decide the management in pre operative period and detect the post operative infections as well as management respectively.

HO Ayo and CN Mcharo study showed that the elevated CRP level on the third postoperative day and continued persistence thereafter in patients with SSI is, however, a potential early screening tool for infection before clinical signs of infection appear on the fifth postoperative day[9,35,40]. In our study none of our patients had elevated level of C reactive protein at 4th POD, which indicates none of our patients had surgical site infection.

The Ellisgaard et al 1991, showed that CRP was used to detect the early post operative infection after hip fracture surgery[32]. In our study no

patient had post operative implant related infection .All patient had post operative CRP values <6 on both 4th and 28th POD.

In 1976, Fisher et al and Shih et al and in 1984, Aalto et al have also reported that CRP profile can be used to diagnose postoperative and post-traumatic septic complication. Subsequent rise in the CRP levels or persistently high values beyond third day should alert the surgeon of possible septic complications[37,38]. In our study , C R P profile is used to diagnose post operative infection. None of our patients had elevated C R P level at 4th POD and 28th POD which shows no patients had post operative infection.

Postoperative infection are two types. They are superficial soft tissue infection and deep implant related infection . Waldvogel et al described that 75% of the infections mainly due to staphylococcus aureus. Zimmerli et al described that coagulase negative staphylococcus aureus are predominant in post opertative implant related infection. Segawa et al in described that gram + ve aerobic group is the commonest one present in post operative implant related infection.

In our study, the most common organisms isolated from the distant musculoskeletal infective focus was staph aureus (60%),staphylococcus epidermidis (15%),Pseudomonas(10%) and Klebsiella (15%). None of our patients had post operative implant infection.

In considering superficial surgical site infection (SSI) , staph aureus is the most common organisms. Two patients in our study had serous discharge which on culture and sensitivity revealed no organisms.

Postoperative implant related infection(PII) , mostly monomicrobial in nature. Poly microbial is very rare. In our study, none of the patients had post operative implant related infection.

Kaltsas et al in 1997 reported that the infections occur within 12 weeks post operatively due to hematogenous invasion of bacteria into the patient from distant musculoskeletal infective foci. In our study ,we followed the patient in first, third and sixth month post operatively, in which none of the patients turned up with post operative infection.

Though we are able to isolate the organisms from the distant musculoskeletal infective foci pre operatively, in our study there was no superficial surgical site infection as well as post operative deep implant related infection from the distant musculoskeletal infective foci.

Since the study follow up period was less, there may be a possibility of late implant related infection due to hematogenous spread from any of the distant musculoskeletal infective foci.

ANTIBIOTIC PROPHYLAXIS

Standard prophylaxis at each medical center consisted of a first- or second-generation cephalosporin; Vancomycin should be reserved for patients with severe β-lactam allergy.

Adequate serum concentration of antibiotics against the expected organism is mandatory in the per operative and post operative period. Mangaram et al suggested the methodology of antibiotic application in 1999. The mean period between the administration of antibiotics and lowering the CRP to the cut off value of <6 was 14 days in our study. Cefotoxime and amikacin were the most commonly used antibiotics to settle down the infection from the distant infective foci preoperatively.

VISUAL ANALOG SCALE (VAS)

The visual analogue scale is a psychometric response scale which can be used in questionnaires. It is a measurement instrument for subjective characteristics or attitude that cannot be directly measured. VAS was used to assess the patients pain, which is one of the indicators of infection in the postoperative period. In our study 2 patients had a score of 4 and all other patients had a score of 2, at the end of third month. Considering pain as one of the indicator of infection, in our study , except 2 patients with a VAS

of 4, all other patients were pain free at the end of the third month.All patients were pain free and had a VAS of zero at the end of 6 months.

ANTICIPATED PROBLEMS

- Antibiotic resistance due to long term intake of antibiotics is one of the threatening complication has not been found in any patients at pre operative period and also post operative period.

- Intra operatively, difficulty in reducing the fracture fragments, so that difficulty to achieve proper alignment of fragments, excessive blood loss, excessive surgical duration.

- Post operatively, hematoma is the root cause of infection.

Good functional result depends on reasonable anatomic reduction of the articular surface or acceptable reduction of shaft of the bone either by direct or indirect methods. Understand the fracture completely before planning any surgery with adequate radiographs, CT scan and radiographs of the uninjured limb. Surgical reconstruction must be tailored to the personality of each fractures and operative approaches dictated by the quality of the soft tissues.

Infection of the implant due to attachment of microorganisms primarily because of contamination at the time of surgery or secondary

bacteremia from distant focus of infection such as osteomyelitis, pyogenic arthritis, infected wound at the extremities. Application of surgical aseptic precaution during the internal fixation of fractures with appropriate antibiotic therapy has been associated with better outcome.

CONCLUSION

A short term follow up of our study results were analyzed and the overall results have encouraged us in preferring the surgical management of fractures with culture proved distant musculoskeletal infective foci elsewhere in the body with proper pre operative planning.

Good results can be obtained in the cases of closed fractures with culture proved distant musculoskeletal infective foci when the surgical intervention is timed at 1 - 4 weeks interval for elevated C Reactive Protein to come down to normal limit.

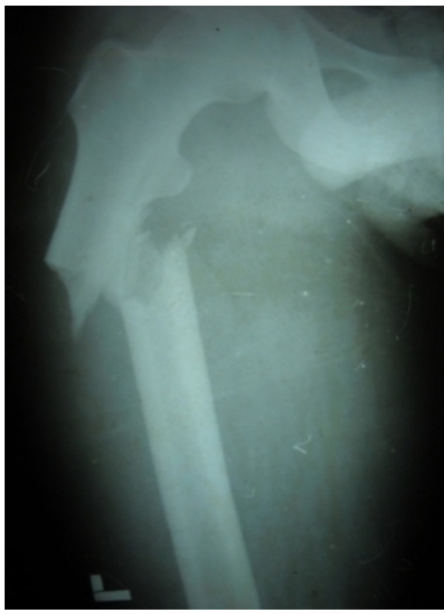
With the recommended normal level of C Reactive Protein and appropriate antibiotics therapy for wound , outcome of internal fixation of closed fractures were found to be safe and effective even with the culture proved musculoskeletal infective focus present elsewhere.

CASE ILLUSTRATIONS

CASE NO : 1

- 24/m 79637
- Alleged H/O RTA (4 wheeler vs 4 wheeler)
- Diagnosis : # Shaft of Femur Left Side / Infective foci at Left Proximal leg Anterior aspect
- P/D : ORIF with Interlocking Nail for Femur

PRE OP (X RAY & WOUND)



PER OP PHOTO

POST OP (IMMEDIATE)

POST OP (3RD MONTH)

POST OP (6TH MONTH)

HIP FLEXION & KNEE FLEXION

SURGICAL SITE

HEALED WOUND

CASE NO-2

- 43 yrs / Male
- Alleged H/o RTA (hit by a four wheeler)
- Sustained injury to left lower limb.
- Pain, swelling and deformity in left thigh
- Pain, swelling and deformity in left leg and open wound
- DIAGNOSIS

  Closed # Shaft of Femur & Grade 3B Compound Segmental # Both Bone Left Leg

PRE OP (X RAY FEMUR & TIBIA)

PRE OP (WOUND)

INITIAL TREATMENT

Wound debridement and external fixation for tibia and Lower femoral pin traction for shaft of femur

POST OP(TIBIA EX FIX)

STAGES OF TREATMENT

- 1ST stage (after 20 days): Split skin graft
- 2nd stage (after 45 days): ORIF with interlocking nailing for femur.

POST OP (IMMEDIATE)

PER OPERATIVE

POST OP (3RD MONTH)

- 3rdstage (after 45 days): External fixation removed and AK slab applied with window.

- 4th stage(5 months follow up): Discharging sinus from SSG site in left leg, pus culture and sensitivity done, staphylococcus aureus sensitive to cephalexin given for 3 wks.
- 5th stage: Sinus tract excision done.
- 6th stage: After 6 months no signs of union noted in the femur planned for Dynamaization

POST OP (6TH MONTH)

- 7th stage: ILIZAROV FIXATION WITH CORTICOTOMY done at two level in the tibia after 7 month
- Patient developed equinus deformity and not able to weight bear and the proximal fracture site in the tibia not united and distal fracture site united.
- 8th stage:Planned for bone grafting for proximal tibia and foot assembly for equinus deformity correction
- Patient allowed full weight bearing the fracture site united in the femur site
- Signs of union in the proximal tibia noted and planned for ilizarov removal

HIP FLEXION & HEALED WOUND

RANGE OF MOVEMENTS

Knee extension:90

Knee flexion :70

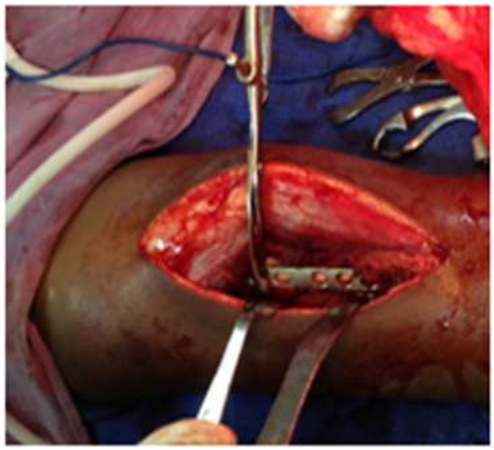
CASE-3

- 31/m 64704
- Alleged H/O RTA
- Sustained injury to both sides of lower extremities
- Diagnosis : Supra condylar # Rt. Femur / # Neck Of Femur Both sides / # Shaft Of Femur Lt / Infective foci at Rt proximal Leg posterior aspect
- P/D : ORIF with Broad DCP Lt Femur / ORIF with Distal femur Locking plate Rt femur / Cancellous screw fixation for Lt NOF # & Rt # NOF

PRE OP (PELVIS & BOTH HIPS)

PRE OP (BOTH SIDE THIGH)

PER OPERATIVE

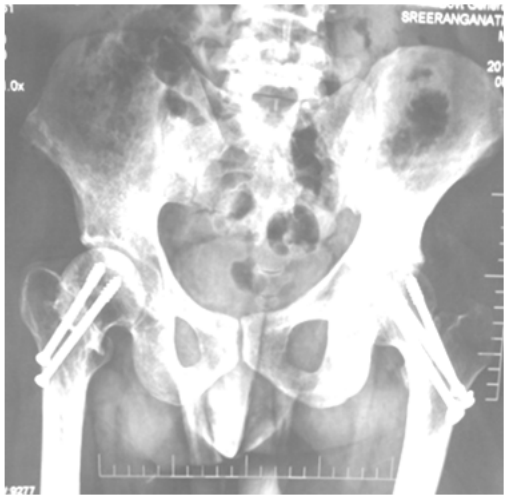


POST OP (IMMEDIATE)

POST OP (IMMEDIATE)

FOLLOW UP (1ST MONTH)

FOLLOW UP (3RD MONTH)



FOLLOW UP (6TH MONTH)

HIP EXTENSION & FLEXION

FOLLOW UP & HEALED WOUND

CASE-4

- 23/m 70892
- Alleged H/O RTA
- Sustained injury to right side
- Diagnosis : Closed # Shaft of Femur Right side / Infective foci at Rt knee (Through Knee Amputation)
- P/D : 1st stage : Split Thickness Skin Graft

  2nd stage : ORIF with Broad DCP / Bone Grafting

PRE OP

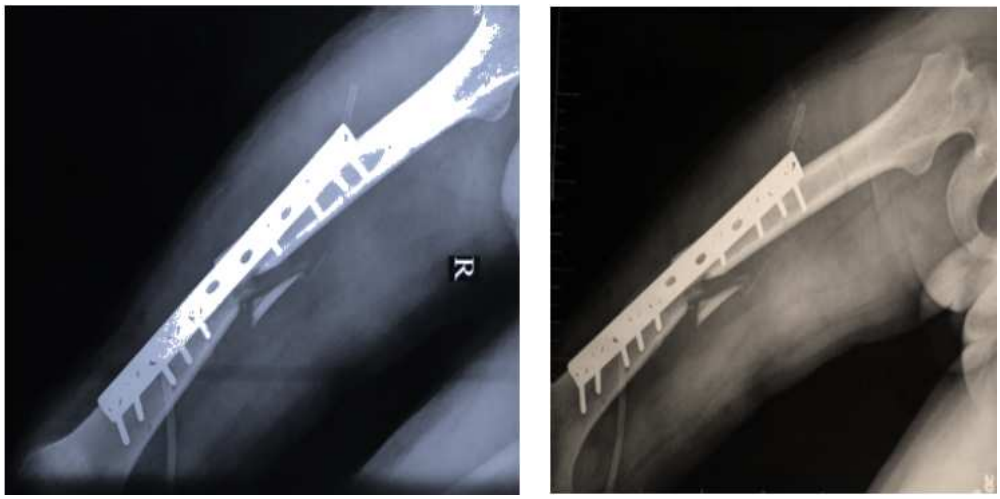
WOUND SITE

PER OPERATIVE

POST OP(IMMEDIATE)

FOLLOW UP(3RD MONTH)

FOLLOW UP(6TH MONTH)



HEALED WOUND

HEALED WOUND

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PROFORMA

Case No: Unit:

Name: Age/Sex:

I.P No: Occupation:

Address: Phone:

Date of Injury:

Date of Admission:

Date of Surgery:

Date of Discharge:

Mechanism of Injury:

- Road Traffic Accident :
- Accidental Fall :

General Condition :

Hemodynamic Status :

Side Involved: (Right/Left) :

X-Ray findings :

Associated other long bone injuries: (Yes/No) :

Associated Head injury: (Yes/No):

Pus culture & sensitivity :

Date of admission	Just before surgery	2th POD

Antibiotic management:

Pre op antibiotics	Just before surgery	Post op antibiotics

C Reactive protein :

Date of admission	Just before surgery	4th POD	28th POD

Erythrocyte Sedimentation rate :

Date of admission	Just before surgery	4th POD	28th POD

Poly morpho nuclear cells count ;

Date of admission	Just before surgery	4th POD	28th POD

VISUAL ANALOG SCALE :

1st MONTH	3rd MONTH	6th MONTH

Treatment in our Institution:

- Time interval between injury and definitive management
- Procedure done

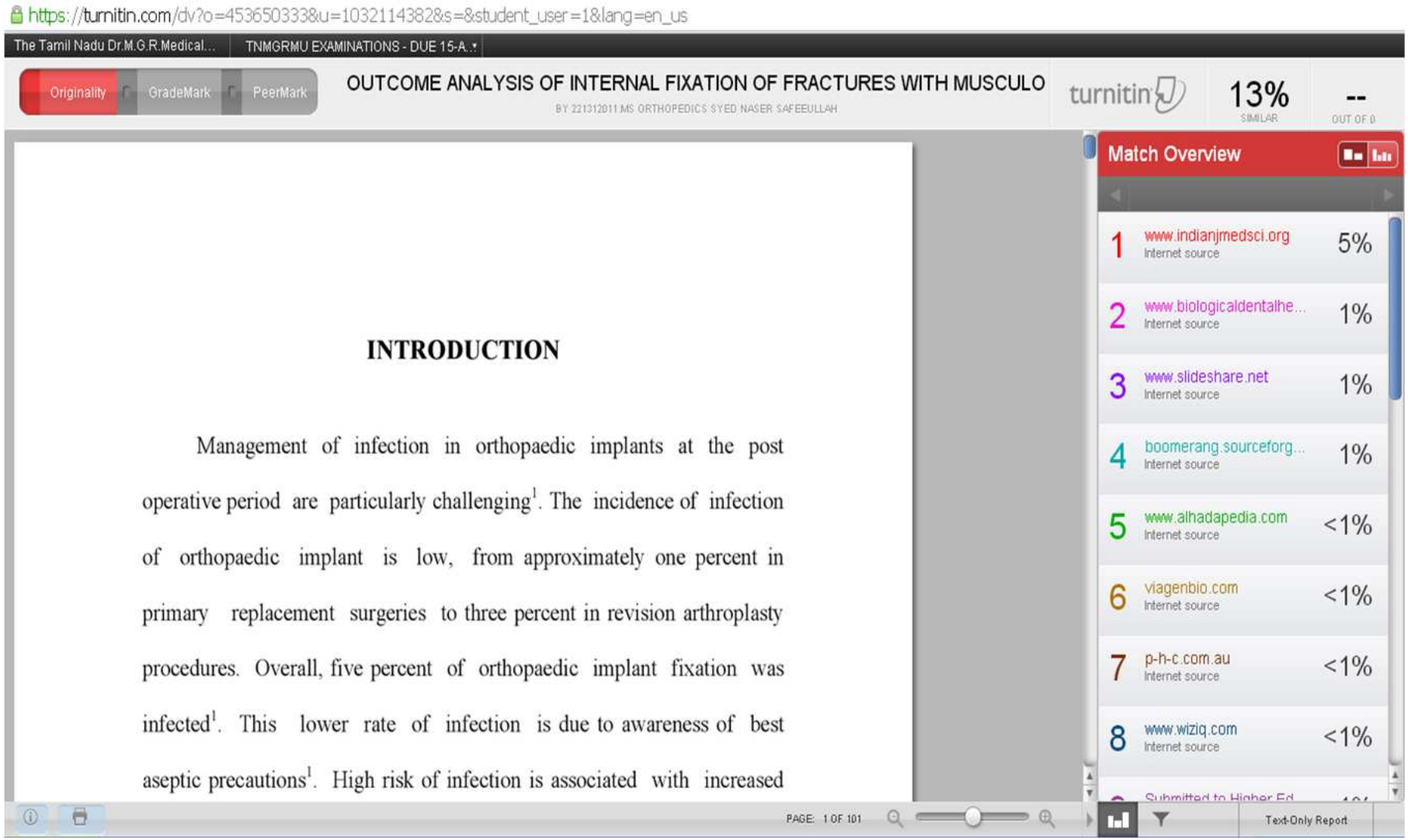
Post Operative Events:

Complication:

Follow Up:

- No. of Weeks since Surgery
- Radiological Picture
- Scar Status
- Complications
- Range of motion

Assistant Professor Signature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INTRODUCTION
Management of infection in orthopaedic implants at the post operative period are particularly challenging[1]. The incidence of infection of orthopaedic implant is low, from approximately one percent in primary replacement surgeries to three percent in revision arthroplasty procedures. Overall, five percent of orthopaedic implant fixation was infected[1]. This lower rate of infection is due to awareness of best aseptic precautions[1]. High risk of infection is associated with increased
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INSTITUTIONAL ETHICS COMMITTEE
MADRAS MEDICAL COLLEGE, CHENNAI-3

EC Reg No.ECR/270/Inst./TN/2013
Telephone No : 044 25305301
Fax : 044 25363970

CERTIFICATE OF APPROVAL

To
Dr. S. Syed Naser,
PG in MS Orthopaedics,
Institute of Orthopaedics & Traumatology,
Madras Medical College &
Rajiv Gandhi Govt. General Hospital,
Chennai-3.

Dear Dr. S. Syed Naser,

The Institutional Ethics Committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled **"Analysis of clinical outcome of Internal fixation of fractures with musculo skeletal infective foci elsewhere in the body "** No.11022014

The following members of Ethics Committee were present in the meeting held on 04.02.2014 conducted at Madras Medical College, Chennai-3.

1. Dr. G. Sivakumar, MS FICS FAIS -- Chairperson
2. Dr. Kalai Selvi, MD -- Member Secretary
   Prof. of Pharmacology, MMC, Ch-3
3. Prof. Dr. K.Ramadevi, MD -- Member
   Director i/c, Instt. of Biochemistry, Chennai.
4. Dr. Geetha Devadoss, -- Member
   Associate Professor of Pathology, MMC,Ch-3.
5. Prof. Dr. Sivasubramanian, -- Member
   I/c Director, Institute of Internal Medicine, MMC, Ch-3.
6. Thiru. S. Govindasamy, BABL -- Lawyer
7. Tmt. Arnold Saulina, MA MSW -- Social Scientist
8. Thiru. S. Ramesh Kumar, AO, MMC, Ch-3. -- Layperson

We approve the proposal to be conducted in its presented form.

Sd/Chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

12/3/14

Member Secretary, Ethics Committee

ஆய்வு தகவல் தாள்

ஆராய்ச்சியாளரின் பெயர் :

ஆய்வு தலைப்பு:

சீழ் தொற்று ஏற்பட காரணமான காயங்கள், உடலில் எலும்பு முறிவு இல்லாத இடத்தில் இருக்கும் போது, கைகள் மற்றும் கால்களில் ஏற்படும் எலும்பு முறிவிற்கு உள்பொருத்துதல் அறுவை சிகிச்சை செய்வதினால் ஏற்படும் மருத்துவ விளைவுகள் பற்றிய ஆய்வு.

சென்னை மருத்துவக் கல்லூரி மற்றும் மருத்துவமனையில் எலும்பு முறிவு ஏற்பட்டு மற்றும் சீழ் தொற்று ஏற்பட காரணமான காயங்களுடன் வரக்கூடிய நோயாளிகளுக்கு உள் பொருத்துதல் அறுவை கிசிச்சை செய்வதினால் ஏற்படும் மருத்துவ விளைவுகள் பற்றிய ஆய்வினை இங்கு செய்து வருகிறோம். அதற்காக நோயாளிகளை தேர்வு செய்கிறோம்.

இந்த ஆராய்ச்சியில் பங்கேற்கும் நோயாளிகளின் விபரங்கள் ஆய்வு முடியும் வரை இரகசியமாக வைக்கப்படும். ஆராய்ச்சியின் முடிவு பற்றிய பாதிப்புகள் அல்லது வெளியீடுகளில் யாருடைய தனிப்பட்ட விவரங்களும் பகிர்ந்து கொள்ளப்படமாட்டாது.

இந்த ஆராய்ச்சியில் பங்கேற்கும் உங்கள் முடிவு தன்னிச்சையானது. இந்த ஆராய்ச்சியில் பங்கேற்கும் எந்த நேரத்திலும் விலகிக் கொள்வதற்கும் உங்களுக்கு வாய்ப்புள்ளது. உங்களின் இந்த தீர்மானத்தினால் உங்களுக்கு இம் மருத்துவமனையில் வழங்கப்படும் பயன்களில் எவ்வித மாற்றமும் இருக்காது.

இந்த சிறப்பு ஆய்வின் முடிவுகள், இந்த ஆய்வின் முடிவில் அல்லது ஆய்வின் போது ஏற்படும் எதிர்மறையான விளைவுகளை அந்நோயாளியின் நலன் கருதியோ அல்லது சிகிச்சையளிக்கும் பொருட்டோ நோயாளிகளுக்கு தெரிவிக்கப்படும்.

ஆய்வாளரின் கையொப்பம்

தேதி :

நோயாளியின் கையொப்பம்

PATIENT CONSENT FORM

Study Detail : **ANALYSIS OF CLINICAL OUTCOME OF INTERNAL FIXATION OF FRACTURES WITH MUSCULO SKELETAL INFECTIVE FOCI ELSEWHERE IN THE BODY**

Study Centre : RajivGandhiGovernment GeneralHospital, Chennai.

Patient's Name :

Patient's Age :

Identification Number :

Patient may check (V) these boxes

a) I confirm that I have understood the purpose of procedure for the above study. I have the opportunity to ask question and all my questions and doubts have been answered to my complete satisfaction. ❑

b) I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving reason, without my legal rights being affected. ❑

c) I understand that sponsor of the clinical study, others working on the sponsor's behalf, the ethical committee and the regulatory authorities will not need my permission to look at my health records, both in respect of current study and any further research that may be conducted in relation to it, even if I withdraw from the study I agree to this access. However, I understand that my identity will not be revealed in any information released to third parties or published, unless as required under the law. I agree not to restrict the use of any data or results that arise from this study. ❑

d) I agree to take part in the above study and to comply with the instructions given during the study and faithfully cooperate with the study team and to immediately inform the study staff if I suffer from any deterioration in my health or well being or any unexpected or unusual symptoms. ❑

e) I hereby consent to participate in this study. ❑

f) I hereby give permission to undergo detailed clinical examination, Radiographs ,blood investigations and surgical procedure as required. ❑

Signature/thumb impression

Patient's Name and Address:

Signature of Investigator

Study Investigator's Name:**Dr. S . SYED NASER**

PATIENT INFORMATION SHEET

TITLE OF THE STUDY :**Analysis of Clinical Outcome of Internal Fixation of Fractures with Musculo Skeletal Infective foci elsewhere in the body.**

We are conducting a study on **"ANALYSIS OF CLINICAL OUTCOME OF INTERNAL FIXATION OF FRACTURES WITH MUSCULO SKELETAL INFECTIVE FOCI ELSEWHERE IN THE BODY"** among patients admitted in the Institute of Orthopaedics & Traumatology, Rajiv Gandhi Government General Hospital, Chennai.

The purpose of this study is to evaluate and analyse the clinical outcome of internal fixation of fractures with musculo skeletal infective foci elsewhere in the body.

We are selecting certain cases based clinical pattern of fracture with musculo skeletal infective foci elsewhere in the body and if you are found eligible, we perform surgical procedure for the fractured limb by any internal fixation technique or if you are all already operated for the fracture by internal fixation with infective foci elsewhere, we will evaluate the outcome of surgery, which in any way do not affect your final report or management.

The privacy of the patients in the research will be maintained throughout the study. In the event of any publication o r presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which you are otherwise entitled.

The results of the special study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

Signature of Investigator

Signature of Participant

Date :

சுய ஒப்புதல் படிவம்

ஆய்வு தலைப்பு:

சீழ் தொற்று ஏற்பட காரணமான காயங்கள், உடலில் எலும்பு முறிவு இல்லாத இடத்தில் இருக்கும் போது, கைகள் மற்றும் கால்களில் ஏற்படும் எலும்பு முறிவிற்கு உள்பொருத்துதல் அறுவை சிகிச்சை செய்வதினால் ஏற்படும் மருத்துவ விளைவுகள் பற்றிய ஆய்வு.

பெயர் :

தேதி :

வயது :

வெளி நோயாளி எண் :

பாலினம் :

ஆராய்ச்சி சேர்க்கை எண் :

முகவரி :

நான் ..... இந்த படிவத்தில் உள்ள தகவல்களை படித்ததேன். (அல்லது எனக்கு படித்துக் காட்டப்பட்டது). நான் இந்த மருத்துவ ஆராய்ச்சி பற்றி எந்தவித தயக்கமுமின்றி தகவல்களை கேட்டுப் பெற்றக் கொண்டேன். நான் 14 வயதைக் கடந்தவர் என்றும், இந்த ஆராய்ச்சியில் முழு சுதந்திரத்துடன் பங்கேற்க சம்மதம் என்றும் தெரிவித்துக் கொள்கிறேன்.

1. நான் இந்த ஒப்புதல் படிவத்தை படித்து, இதில் உள்ள தகவல்களை நன்கு புரிந்து கொண்டேன்.
2. எனக்கு இந்த ஒப்புதல் ஆவணம் பற்றி நன்றாக விளக்கப்பட்டது.
3. எனக்கு இந்த ஆய்வின் தன்மையைப் பற்றி விளக்கப்பட்டது.
4. என்னுடைய உரிமை மற்றும் பொறுப்புகள் ஆராய்ச்சியாளர்களால் விளக்கப்பட்டது.
5. நான் இந்த ஆராய்ச்சியிலிருந்து எந்நேரமும் பின் வாங்கலாம் என்பதையும்,அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்து கொண்டேன்.
6. இந்த ஆய்வின் மூலம் பெறப்பட் எனது முடிவுகளை வெளியிட விளம்பரதாரர் கட்டுப்பாட்டு அதிகாரிகள், அரசு நிறுவனங்கள் மற்றும் நன்னெறிக் குழு (IEC)க்களுக்கு அனுமதி அளிக்கிறேன்.
7. என்னைப் பற்றிய அடையாளங்கள் இரகசியமாகவும், என் ஆய்வு விவரங்களை பொதுவில் வெளியிடுவது பற்றிப் புரிந்துக் கொண்டேன்.
8. என்னுடைய சந்தேகங்களுக்குண்டான பதில்கள் திருப்தியுடன் பெற்றுக் கொண்டேன்.
9. நான் இந்த ஆராய்ச்சியில் பங்கு பெற முடிவு செய்திருக்கிறேன்.

எனக்கு இந்த ஆய்வின் போது எழும் சந்தேகங்களை ஆராய்ச்சியாளர்களிடம் கேட்டு தெரிந்து கொள்ள வேண்டும் என்பதை அறிவேன். நான் இந்த ஒப்பந்த படிவத்தில் கையொப்பமிடுவதன் மூலம், இந்த ஆய்வைப் பற்றி எனக்கு நன்றாக விளக்கப்பட்டது எனவும் ஒப்புதல் அளிக்கிறேன். எனக்கு இந்த ஒப்புதல் ஆவணத்தின் நகல் வழங்கப்படும்.

.....	.....	.....
நோயாளியின் பெயர்	கையொப்பம் / கைரேகை	தேதி
.....	.....	.....
சாட்சியாளரின் பெயர்	கையொப்பம் / கைரேகை	தேதி
.....	.....	.....
ஆராய்ச்சியாளரின் பெயர்	கையொப்பம் / கைரேகை	தேதி

S no	Name Age Sex	IP no	Diagnosis	Infective site	Pre operative evaluation				Antibiotics	Procedure done	Post operative evaluation					Follow up				Surgical site Infection	Compli Cations	Out come
					CRP		Pus-C&S				CRP		VAS		Antibiotics	2nd week	1st month	3rd month	6th month			
					Day of admission	Just before surgery	Day of admission	Just before surgery			4th pod	28th pod	1st month	3rd month								
1	Ramarajan 24/m	79637	# Shaft of Femur Left	Left leg	14	5	Staph aures/ c.bactm	Staph aures/ c.bactm	c.bactum	Interlocking Nail	2	1	4	2	c.bactum/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
2	Sri Ranganathan 31/m	64704	SC#Rt.Femur/# Neck Of Femur Both sides / # Shaft Of Femur Lt	Rt Leg	12	5	S. aures/ Taxim	S. aures/ Taxim	Taxim	BDCP Lt Femur / LCP Rt femur / Cancellous screw B/L NOF	3	1	6	4	Taxim/ Amikacin	Mild Serous discharge	Union -- No infection	Union + No infection	Union + No infection	No	Stiffness	Fair
3	Sasi kumar 23/m	70892	# Shaft of Femur Right	Rt knee	20	4	Klebsiela/ Amikacin	Klebsiela / Amikacin	Amikacin	Broad DCP	3	2	4	2	Amikacin/ C,bactum	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
4	Pandian 43 / M	60071	#Shaft of Femur left	Left Leg	24	4	S. aures/ cephalexin	S. aures/ cephalexin	cephalexin	Interlocking nailing	3	2	4	2	Taxim/ Amikacin	No infection	Non union+ No infection	Non Union+ No infection	Union + after dynamise	No	Stiffness Delayed union	Fair
5	Prabhavathy 24/f	38750	# Talus & Calcaneum left	Rt foot	18	5	Pseudo monas/ amikac	Pseudo monas/ amikac	Amikacin	Cancellous screws	3	1	4	2	Amikacin/ Taxim	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
6	Arul raj 19/m	47116	# Shaft of Femur left	Left foot	26	5	S. aures/ c.bactm	S. aures/ c.bactm	c.bactum	Broad DCP	3	1	4	2	c.bactum/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
7	Madhubalan 15/m	40666	# Shaft of Femur right	Right ankle	30	5	S.aureus/ taxim	S.aureus/ taxim	Taxim	Broad DCP	3	1	4	2	Taxim/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
8	Ramesh 35/m	68470	# Shaft of Femur right	Rt foot	28	5	S. aures/ vanco	S. aures/ vanco	vancomycin	Interlocking nailing	3	2	6	4	Vancomycin/ Amikacin	Minimal discharge+	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
9	Pandurangan 32/m	60965	# Dista Radius/ Distal Ulna#	Left Knee/ Left leg	20	3	Klebsiella/ ofloxacin	Klebsiella/ ofloxacin	Ofloaxin	Asian DCP ulna K wire Radius	3	1	4	2	Ofloaxin/ Piptaz	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good

S no	Name Age Sex	IP no	Diagnosis	Infective site	Pre operative evaluation					Procedure	Post operative evaluation					Follow up				Surgical site infection	Complications	Out Come
					CRP		Wound C&S		Antibiotics		CRP		VAS		Antibiotics	2nd week	1st month	3rd month	6th month			
					Day of admission	Just before surgery	Day of admission	Just before surgery			4th pod	28th pod	1st month	3rd month								
10	Vinoth 24/m	123728	# L1 Vertebrae	Left chest	28	4	Saures/ Taxim	Saures/ Taxim	Taxim	Anterior Decompression	3	1	4	2	Taxim/ Amika	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
11	Arivazhagn 25/m	5797	Pubic diastasis	Iliac crest	16	4	SEpi/ C.Bact	SEpi/ C.Bact	C. Bactum	Rrecon Plate	2	1	4	2	c.bactum/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
12	Baska35/ M	3349	#SOF (B/l) # IT Left # Patella	Left Leg/ Left thigh	32	3	MRSA/ Vanco	MRSA/ Vanco	Vanco	Inter locking nailing	2	1	4	2	Vanco/ Amikacin	Discharge +	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
13	Veera raghavan 35/M	8819	Burst L1#, IT # Rt , #BB Rt leg,	Lt leg	34	4	MRSA/ Vanco	MRSA/ Vanco	Vanco	Posterior stabilisation decompression	2	1	4	2	Vanc/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
14	Dharani 60/m	11062	Galeazzi # left	Left leg	28	4	S aures/ c.bactm	S aures/ c.bactm	C. bactum	Asian DCP	3	1	4	2	c.bactum/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good
15	Philip kumar 21/M	51378	# SOF	Rt leg	22	4	Kleb/ C.bactum	Kleb/ C.bactum	C. bactum	Inter locking nailing	3	1	4	2	c.bactum/ Amikacin	No infection	Union + No infection	Union ++ No infection	Union ++ No infection	No	Nil	Good

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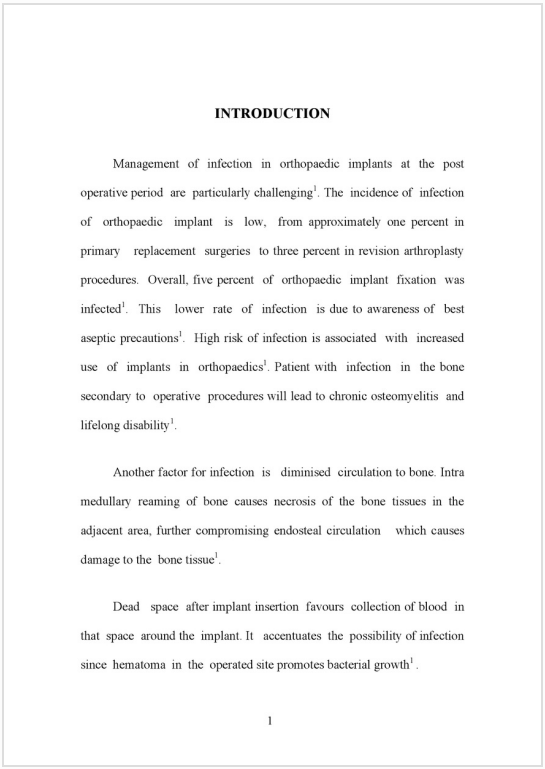

INTRODUCTION

Management of infection in orthopaedic implants at the post operative period are particularly challenging[1]. The incidence of infection of orthopaedic implant is low, from approximately one percent in primary replacement surgeries to three percent in revision arthroplasty procedures. Overall, five percent of orthopaedic implant fixation was infected[1]. This lower rate of infection is due to awareness of best aseptic precautions[1]. High risk of infection is associated with increased use of implants in orthopaedics[1]. Patient with infection in the bone secondary to operative procedures will lead to chronic osteomyelitis and lifelong disability[1].

Another factor for infection is diminised circulation to bone. Intra medullary reaming of bone causes necrosis of the bone tissues in the adjacent area, further compromising endosteal circulation which causes damage to the bone tissue[1].

Dead space after implant insertion favours collection of blood in that space around the implant. It accentuates the possibility of infection since hematoma in the operated site promotes bacterial growth[1].

1